



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification<sup>6</sup> :

F16L 27/00, B25J 1/02

A1

(11) International Publication Number:

WO 96/24000

(43) International Publication Date:

8 August 1996 (08.08.96)

(21) International Application Number:

PCT/US96/01209

(22) International Filing Date:

31 January 1996 (31.01.96)

(30) Priority Data:

112494	31 January 1995 (31.01.95)	IL
112772	24 February 1995 (24.02.95)	IL
112845	2 March 1995 (02.03.95)	IL

(60) Parent Applications or Grants

(63) Related by Continuation

US	08/088,570 (CIP)
Filed on	9 July 1993 (09.07.93)
US	08/238,299 (CIP)
Filed on	5 May 1994 (05.05.94)

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(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AZ, BY, KG, KZ, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

## Published

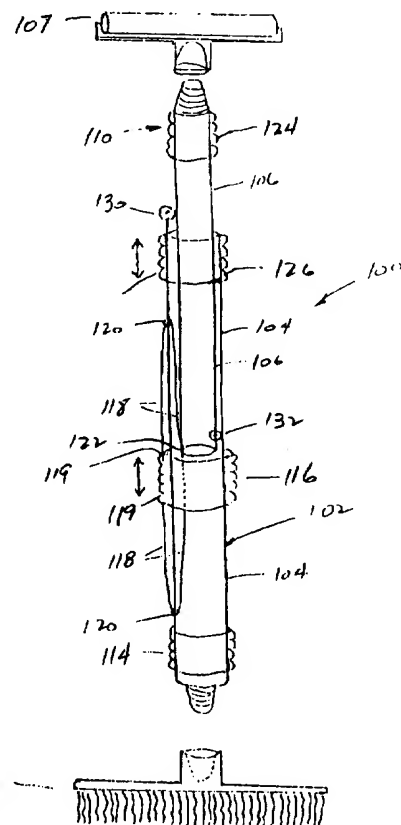
With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: EXTENSIBLE AND RETRACTABLE ELEMENTS AND VARIOUS USES FOR THE ELEMENTS

## (57) Abstract

A telescopic tube (100) includes a moveable handle (116) which is attached to cables (118) for causing the tube portions (104, 106) to extend telescopically or retract. Various applications are disclosed for using the telescopic tube (100).



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## EXTENSIBLE AND RETRACTABLE ELEMENTS AND VARIOUS USES FOR THE ELEMENTS

The present invention relates to a wide variety of devices and products and for many uses in different fields, involving principles that were never used before in the field of telescopic structures and their movement. In addition, the present invention relates to devices for multiplying the effective physical work achieved by simple hand and leg movements by a novel motion transmission system.

### BACKGROUND OF THE INVENTION

In many fields, there exist inventions to multiply man's capability. For example, the telephone and microphone multiply the range and power of man's voice, and the computer multiplies man's calculation ability several fold. The car multiplies man's travel ability in reaching his destination, while motors and engines multiply his strength. However, many hand and leg movements are needed to perform simple tasks.

The telescopic structures that exist today are mostly in the field of cranes, and the telescopic cranes are used mostly to lift things from place to place and to reach different heights. The basic telescopic cranes have: 1) a base 2) a motor to activate (in and out) the telescoping parts, 3) a system to hold and move the telescopic system to the desired place, (to the sides and to different heights) and 4) an end of the telescopic crane that has the capability of performing the different jobs.

The present invention uses new principles that relate

to the structure and movement of such telescopic systems, which were initially disclosed by the present inventor in PCT application published under WO 94/01254, and US Patents 5,322,334 and 5,324,086.

Today, there are many products which require a person to apply a great deal of effort and time to operate, which sometimes even endanger the operator's health and security. For example, in order to erect and stabilize a camera tripod, as many as fourteen similar, repetitive movements are required. Another example involves the activity in using vacuum cleaner tools, in which the user must engage in many bending movements which damage the back, and present difficulty in reaching high areas which must be cleaned. Still another example involves the use of spray equipment or fire extinguishing equipment in which the user is too close to the chemicals sprayed, and inhales them, which is dangerous.

The existing products do not address the problems of difficult and strenuous body movements, as described above. Thus, it would be desirable to provide products which solve the problems described, and simplify the effort and shorten the time required for operation.

#### SUMMARY OF THE INVENTION

Accordingly, it is a principal object of the present invention to overcome the problems of existing products requiring hand movements for their operation, and provide a system of telescopic elements for multiplying the effective physical work achieved by simple hand and leg movements. This multiplying of

the effects of hand movement, and control over the telescopic motion of structures and their length, can be implemented in many fields including cleaning systems, vacuum cleaners, measuring rods, tools, paint rollers, wall scrapers, music stands and instruments, parasols, shades, curtains, sailing boats, and structures such as chairs, tripods, tables, tents, etc. Other advantages of the invention are in the field of cargo transportation and delivery from one place to the other.

In a preferred embodiment of the present invention, there is provided a motion transmission and multiplication system comprising:

at least first and second elements extending in the same orientation; and

at least a first means linking said first and second elements and being movable with respect to at least one of them,

said first linking means being arranged on said first element such that motion thereof in a direction of said orientation drives motion of said first and second elements with respect to each other.

In a preferred embodiment, a pair of elements are arranged in proximity to one another with a flexible loop connecting them in such a way as to develop motion transmission between them when the flexible loop is moved. This design can be extended to include additional elements which are linked together.

In another embodiment, a pair of cylindrical tubes are nested one within another, with a loop passing through a pair of holes formed on the outer tube, so that its long sides are internal and external to the tube. The loop is connected on its

internal side to a posterior portion of the internally nested tube, such that lateral movement of the loop causes the internally nested tube to emerge from and retract within the outer tube.

The invention can be applied to many devices and products, which can be improved substantially so as to increase the simplicity of operating them. The improvements include increasing the speed of performance, as in deployment of a tripod, which typically requires many movements for opening, balancing, and closing it. Another example is in speed and simplicity of cleaning efforts, by use of a telescopic vacuum cleaner tool, which can quickly deployed at any length desired. The functions of many devices and products can be improved, such as by reaching difficult heights through the telescopic vacuum cleaner pipe, or painting with a roller etc.

The invention saves energy by eliminating the need of lifting up the broom each time a cleaning movement is made. In all of its applications, time saving is achieved, such as in materials handling, transporting, and moving cargoes from place to place.

An additional advantage of the invention is that it enables the user to maintain good health by saving on body movements in operating tools so as to avoid backaches, such as by cleaning with a telescopic pipe of a vacuum cleaner, cleaning with a telescopic broom, creating a distance between the user and the place the job is being done, like spraying paint or chemicals or water on fire when using the telescopic pipe to lengthen the

tool and maintain a safe distance from the danger. This telescopic pipe can also reach different heights and it can be fitted with sensors to move the pipe in a periodic way relating to the length of the movement desired and/or the velocity of the movement desired.

Because of the special nature of the invention that enables many improvements in different products and fields, only chosen representative examples are presented herein, and there are many others.

The following examples relate to several fields of application, from simple to complicated, in the order as follows:

1. One motion multiplier system for different uses:
  - a) pipes with 2 or more telescopic segments
  - b) motorized telescopic pipes
  - c) motion transmission in side-by-side arrangements of elements
2. Music instruments with a telescopic structure
3. A system for multiplying movement that operates from one central point to telescopic structures: tripod for a cameras, stand for music sheets, etc.
4. A system for locking and sealing the segments from one central point to many telescopic structures like: locking a tripod (or a pipe for a vacuum cleaner) and the like.
5. A system for multiplying movement that operates from one central point to many telescopic structures, while using connections placed on the segments of the telescopic structures and their movement like: a telescopic umbrella, parasol, awning etc. These structures can also be built as side-by-side elements.
6. A handling system for a telescopic movement in tracks like: curtains, shutters, sail boats, telescopic cars for cargo

transfer etc.

7. A telescopic structure that contains different devices and their wiring and cables, flexible hoses, etc. to enable different activities as it moves in linear and rotation movements.

Other features and advantages of the invention will become apparent from the following drawings and description.

#### BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention with regard to the embodiments thereof, reference is made to the accompanying drawings, in which like numerals designate corresponding elements or sections throughout, and in which:

Fig. 1 is a front view of a preferred embodiment of a tool which is extendible in telescopic fashion from either end;

Figs. 2-6 show activities performed with the Fig. 1 tool;

Figs. 7-9 show telescopically extendible pipes which use a gearwheel arrangement for motion transmission;

Figs. 10-13 show a telescopically extendible pipe usable as a vacuum cleaner tool;

Fig. 14 shows the motion transmission system of Figs. 10-13 for attachment to existing vacuum cleaner tools;

Fig. 15a shows a telescopically extendible pipe with an adjustable extension range;

Fig. 15b shows the motion transmission system of Fig. 15a for attachment to existing vacuum cleaner tool;

Figs. 16-18 show automatically extendible pipes;

Figs. 19a-c and Fig. 20 show ways of grasping and manipulating tools constructed using the pipes of Figs. 16-18;



Figs. 21,23 show telescopically extendible pipes constructed with a protection sleeve for vacuum cleaner tools;

Fig. 22 shows a telescopically extendible pipe with a control cable for a vacuum cleaner motor;

Fig. 24 shows a pipe with an adjustable extension range;

Fig. 25 shows an extendible pipe with an internal motion transmission arrangement;

Fig. 26 shows a shoulder strap for carrying a pipe;

Figs. 27a-b,28 show a telescopic measuring tape;

Fig. 29 shows a telescopically extendible drill;

Fig. 30 shows a rotatable telescopically extendible pipe;

Figs. 31a,b and 32 show a broom tool with angular control;

Figs. 33a-c show a telescopically extendible tripod leg;

Fig. 34 shows a complete tripod assembly per Figs. 33a-c;

Figs. 35a-b show an alternative tripod leg embodiment;

Fig. 36 shows a complete tripod assembly per Figs. 35a-b;

Figs. 37a-c shows another alternative tripod leg;

Figs. 38-39 show a tripod leg with central locking;

Figs. 40a-b show a telescopic music stand embodiment;

Fig. 41 shows a telescopic umbrella embodiment;

Fig. 42 shows a telecopic parasol embodiment;

Fig. 43 shows a telescopic awning embodiment;

Fig. 44 shows a motion multiplier for a curtain system;

Fig.45 shows an alternative curtain motion system;

Fig. 46 shows a motion multiplier for a conveyor system;

Fig. 47 shows a motorized motion multiplier for a conveyor;

Figs. 48-52 show a telescopic facility device;

Fig. 53 shows a telescopic wind instrument;  
Fig. 54 shows a telescopic percussion instrument;  
Fig. 55 shows a telescopic illumination system; and  
Figs. 56-57 show telescopic sailboat masts.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As will be apparent from the following description, the inventive principle is applicable to many embodiments, and to further the understanding of the invention, these embodiments have been labeled with a short heading to assist the reader.

##### TWO-SEGMENT PIPE

Referring to Fig. 1, there is shown a preferred embodiment of a tool 100 which can be operated from either side. In Fig. 1 there is seen a pipe 102 with two segments 104, 106 (or more) on which there can be assembled different tools at either end as needed. In the figure, a roller 101 for painting is assembled on the top end 110. The roller and pipe are operated by holding the fixed handle 114 in one hand, and operating the activation handle 116 (that moves on and along segment 104) with the other hand. This moves segment 106 up and down through motion of straps 118 which are attached at either end to handle 116 at points 119 with the loop sliding through holes 120 formed in segment 104, and being attached to end 122 of segment 106, such that roller 101 turns and moves up and down, to perform the paint job.

In this activity, the operating hand moves handle 116 in the opposite direction to the motion of segment 106, thus enabling the user to reach greater distances, which is good for

working at heights for painting the wall, fruit picking, tree trimming, cleaning high windows etc. (See Figs. 2-4)

In contrast to the previous description, the device can be operated in the same direction as the hand motion. The pipe can be operated from its other end and then one hand will hold the handle grip 124 at the top end 110 of segment 106, and the other hand will move and operate the activating handle 126 on segment 104, which will move the second segment 104 back and forth on segment 106, as needed. In this activity, the operating hand moves in the same direction as the motion of segment 104, which is effective for working in lower places, and with a broom or sweeper, etc. (See Figs. 5-6)

Also shown in Fig. 1 are pulleys 130, 132, which function to create smooth movement of the segments with minimum friction, and to balance them. The pulleys are one possible solution, but any other technical solution will be possible for eliminating friction and providing balance. The main improvement accomplished by this device is that, unlike with existing devices, which require bending and moving the body and legs while cleaning with a broom, the inventive device enables the user to stand straight, and perform the cleaning activity simply by moving his hand, without the need for bending.

In Fig. 7, there is shown a telescopic system for multiplying manipulation effort and reducing deployment time. Its purpose is to develop a system in which a short movement drives a joint telescopic system (e.g. an extendible telescopic pipe), to produce a movement longer than the short, driving movement. This

can be applied to an extendible telescopic pipe with two segments, which enables a small movement in the first segment to produce a longer movement in the rest of the telescopic pipe segments. This will be effective, for instance, in an extendible telescopic pipe in which each of its segments has a length of 2.0 meters, and with a driving movement of 0.5 meter of the movement handle, the second segment moves simultaneously 2.0 meters. This pipe could be usable for brooms, paint brushes, gardening tools, vacuum cleaners and many other applications.

In Fig. 7, there is shown a pipe with two segments. In the initial position, one hand grasps the fixed handle 114 which is positioned on the edge of segment 104. The other hand holds the activation handle 116 that moves along and on the first segment 104.

The pipe can be opened by pushing the activation handle 116 forward (left in the drawing) to activate and move the toothed loop 140 that will move and rotate the small gearwheels 142, 144 clockwise. As a result, the large gearwheel 146 will rotate since it is connected to small gearwheel 142 and both spin on an axle connected to the first segment 104. The rotation of gearwheel 146 will move the toothed rail 148 (positioned along the second segment), and will cause the second segment 106 to emerge out of the first segment 104 (another arrangement is possible instead of the toothed rail 148).

Since gearwheel 146 is larger in diameter than gearwheel 142, a short activation movement of the activation handle 116 forward produces a larger movement that will draw the full length of the second segment 106 out of the first.

### THREE-SEGMENT PIPE

In Fig. 8, there is shown a pipe 107 of three segments. It is possible to add an additional segment 108 and it will function as an additional telescopic segment which moves with movement of handle 116. It is possible that the whole or part of the movement system will be on segment 104. The movement handle 116 could activate the toothed loop 140 by locking on it anywhere along it on one of its sides, with the assistance of either of bolts 150,152 and keys 151,153. This will enable activation of the telescopic pipe in a movement consistent with the movement of the segments going in and out, or in the opposite direction. Thus, if bolt 152 is locked on strap 140, the movement of the pipe segments 106-108 will be like that of handle 116, which is suitable for low cleaning activities. If bolt 150 is locked onto strap 140 (bolt 150 is released) the movement of handle 116 will be in the opposite direction to that of segment 106, which is suitable for high cleaning activities.

In addition, movement of handle 116 in short strokes, when the user holds the telescopic pipe with both hands spaced far apart, enables the pipe to be held in stable fashion compared to the situation when both hands are close to each other while in motion. Bolt 154 enables locking the pipe at the desired length.

In Fig. 9, a toothed rail 156 which is connected to the activation handle 116 will activate the small gearwheel 142 while handle 116 is moves. Toothed rail 156 replaces loop 140 and all operations are as described with regard to Figs. 7,8 herein.

## TELESCOPIC VACUUM CLEANER TOOL

In Fig. 10, there is shown a system for moving segments of a pipe provided as vacuum cleaner tool. The purpose of the invention is to move segments simultaneously, with one movement. In this way, a vacuum cleaner tool can be designed for use comfortably, while reaching different heights with the tool. This design also enables cleaning dust from the floor without bending. Another solution is to create an movement system outside the segments. This development is intended mainly for a vacuum cleaner, but can fit many other applications as well. An explanation of the mode of operation of the tool is presented.

In Fig. 10, segment 106 is shown emerging from segment 104. A fixed handle 114 is positioned on the edge of the first segment 104. The activation handle 116 slides above and along segment 104. Handle 116 has an arm 160 attached at point 162 to the edge of the second segment 106. The moment activation handle 116 is pushed forward (left in the drawing), segment 106 emerges from segment 104. Pulling the handle back (right in the drawing) causes segment 106 to enter segment 104.

In Fig. 11, a loop or strap 118 is added. Loop 118 is fixedly attached to the edge of segment 104 at point 164. The loop is positioned between and above two pulleys 166, 168 which are mounted to the arm at both sides. Moving the activation handle 116 forward moves loop 118 counter-clockwise between the pulleys, as loop 118 is held at point 164.

In Fig. 12, movement of loop 118 causes a second arm 170 (attached to the loop at point 172 and passing through hole 174)

to move forward (left in the drawing).

In Fig. 13, a third segment 108 has been added and attached to arm 170 at point 176. Every time the activation handle 116 moves, second arm 170 will move third segment 108 in and out of segment 106. Thus, moving handle 116 moves the second segment 106 in and out of segment 104. This movement causes loop 118 to move and turn counter clockwise. The second arm 170 moves through hole 174 formed in first arm 160. Movement of loop 118 will move arm 170 which is attached thereto at point 172, and this in turn moves third segment 108 in and out of segment 106, by attachment at point 176.

In Fig. 14, there is shown a system of the type shown in the previous Figs. 10-13, which can be manufactured for connection to an existing vacuum cleaner tool to operate it as described. Screws 163, 180 or any other bolting means, can be mounted to arms 160, 170 and will attach to the segments accordingly. The connection point 182 on loop 118 can be connected to the edge of the appropriate segment. The activation handle 116 moves on the same segment. In accordance with the same principle, a telescopic movement system can be assembled of three arms (with two loops) or more.

It is also possible to move three of these systems simultaneously, from a specific center, for opening and closing a tripod with three segmented legs. The system can be activated by a motor, as described in previous applications.

In Figs. 15a-b, a system is shown designed with appropriate clips 184, 186 which are adjustable on respective

arms 160, 170 to enable the movement of the pipes' segments in directions previously decided, and within limited ranges. For example, a camera tripod has three segments in each leg. When the invention is assembled on the tripod, each the legs can be opened and closed in one movement. The invention can be assembled on other segments as well. The system can also be designed to provide the moving system without the segments, and can be connected to existing products like legs of a camera stand, etc.

Referring to Figs. 16-18, there are shown pipes constructed for use as vacuum cleaner tools, and for use with sprinklers and other applications, including electric brooms. The pipes 190 include two or three segments 104, 106, 108, handles 114, 116, loop 118, and an elastic hose 192 for vacuumed materials.

A rechargeable battery-driven motor 194 is provided (such as a drill motor), which is operated and rotates when pressing switch 196 in one direction and changes the direction of rotation, when receiving a pulse from the sensors 198, 200 or activating switch 196. When switch 196 is not depressed, motor 194 will stop. Screw 202 is rotationally driven by motor 194 or manually. Motor 194 can be removed and it is possible to activate screw 202 manually by connection at connection point 208.

When nut 204 contacts sensors 198, 200, it sends a signal through an electric wire 205 to motor 194 which then reverses its direction of rotation after receiving the pulse. Sensors 198, 200 can be located anywhere on the first segment, to limit the movements and elongation of the segments. Reversal of direction could also occur by depressing switch 196 in an opposite direction to that depressed previously.



As shown in Fig. 16, screw 202 is in the narrow portion of all segments. The pipe is held at handle 114 with one hand and at handle 116 with the other. Pressing switch 196 will activate motor 194, when switch 196 is depressed, motor 194 rotates clockwise. Motor 194 drives screw 202 in the same direction. Nut 204, threaded on screw 202, will move along it and forward, and because nut 204 is connected to the middle segment 106, its movement will cause segment 106 to move forward on segment 104. Nut 204 moves in a straight line, because it engages a groove or inner track 206, formed in first segment 104. When the middle segment 106 moves away from the first segment 104, loop 118 (or any other movement conveyer) causes third segment 108 to move away from segment 106.

After segments 106, 108 move away from segment 104, at a certain point nut 204 contacts sensor 200. Sensor 200 then transmits a pulse signal through wire 205, to motor 194. This causes motor 194 to reverse its direction of rotation counter-clockwise, and screw 202 rotates in the same direction, to close pipe 190. As a result, nut 204 moves on screw 202, causing second segment 106 to enter onto first segment 104. This also causes segment 108 to enter onto middle segment 106, as it is connected by loop 118.

The pipe 190 can also be closed by depressing switch 196 in the opposite direction to the previous direction, causing motor 194 to rotate in the other direction and closing of the segments onto one another.

In Fig. 17, screw 202 and motor 194 are positioned in

the wider portion of the segments and there is an elastic tube 192 connected for use with a vacuum cleaner, or a spray application. The operation is as described with regard to Fig. 16.

In Fig. 18, screw 202 is positioned outside of the segment and the vacuuming is developed in the pipe and via an elastic tube 192 disposed in it. In addition, Fig. 18 shows the possibility of connecting an external motor 210 (or drill) to the pipe at connection point 208, for motorized pipe operation. Handle 211 is provided for holding the pipe as shown in Fig. 19b. External screw 202 can be driven with rotation by holding the pipe at the other end by handles 124, 126 and moving them apart.

In accordance with the principles of the invention, the pipes shown in Fig. 16-18 can be applied, with appropriate modifications, to other uses such as a pointer rod for teachers and lecturers, a painting tool, extendible broom or mop handle

In Figs. 19a-c, 20 there are shown various ways to grasp the pipe described in the previous figures, to enable efficient manipulation of the tool and application of pressure for vacuuming. The user applies pressure to the pipe with his hands, without requiring bending which causes back aches. In this way, while standing erect, the user of the pipe can hold it in a comfortable way, press the activating switch and effectively apply pressure while directing the pipe to the desired places for the vacuum cleaning, or spraying via hose 212.

The motor-operated pipe can be collapsed and elongated automatically, and the operator will not have to move legs or hands nor engage in bending motion to make this kind of movement. Even with a non-motorized pipe, a man can stand erect and work,

and move only his hands to collapse/elongate the pipe in operation.

In Figs. 21-22, a pipe with two segments is shown. The previous figures can be implemented with a pipe constructed of two segments, and with this pipe, a vacuum cleaner can be connected at the open ends of the two segments. The advantage of this construction is that the pipe is sealed to internal and external infection and there is protection on the outer parts of the pipe through elastic sleeves in the areas of the exposed loops 118 (not shown) and the place of entry of the narrow segment to the wider segment.

In Fig. 21, the mode of operation can be seen. This pipe is activated by holding and moving handles 124, 126 away from each other and closer to each other, and is fit for low activity, like cleaning floors. This pipe includes:

1. An elastic sealed sleeve 215 is connected to segment 106 at point 216 and to segment 104 at point 218 in a way that creates isolation of segment 106 from the outside, and keeps the covered area of segment 106 clean. This enables:

- a. Keeping clean of dust, paint stains, dirt, etc. segment 106, and thus the inner space of segment 104, and also the friction area 220 (which can be lubricated), where segment 106 enters and exits segment 104.

- b. Passing materials through the sealed sleeve if there are spaces between the segments due to different diameters.

Of course, the sealed sleeve will shrink and widen and move together with the movement of segment 106 for it is connected

to it from one side and to segment 104 from the other.

2. An elastic hose 192 for passing materials - from both sides of the pipes' openings at its ends (this was previously described).

In Fig. 22, a device for use with a vacuum cleaner is shown in addition to an assembly for providing control over the vacuum suction power. As in Fig. 21 and in addition to it, there is shown the possibility of operating the pipe from the other end through an activation handle 116 moving on segment 104. To this handle is connected a rack 219 that is connected at its end to the end of segment 106. Moving handle 116 back and forth will make segment 106 to go in and out of segment 104. (This kind of pipe was previously described). This design helps to keep the pipe clean, and to operate it from both sides.

In addition, a cable 222 on the pipe is attached to handle 116. The movement of the handle along segment 104 will stretch and lengthen the cable as the handle moves upwards, and shorten it when the handle moves downwards. Cable 222 is attached at its other end (not seen in the Fig.) to the vacuum cleaner motor, for example, and when cable 222 stretches it controls the vacuum cleaner motor to increase its speed of rotation, thus controlling the motor power. The motor will increase and decrease its activity in a stepwise manner according to the stretching of the cable attached to handle 116 and to the motor itself.

In Fig. 23, there is shown a pipe with three segments. It is operated as with the device of Figs. 21-22, but here protection is provided by elastic sleeve 224 (attached at points 226, 227) which functions as elastic sleeve 215, and also keeps loop 118 clean. The pipe can be activated from the wide end by

any method previously described.

In Fig. 24, there is shown an embodiment containing a combination of the possibilities described so far, with new additions:

1. Middle segment 106 is lifted out of first segment 104 by an arm 230, connected directly to cylinder handle 116 and to the middle segment 106. Pushing the cylinder handle 116 upwards and along the first segment 104 will cause middle segment 106 to emerge out of the first segment 104.
2. It is possible to direct the opening mode of the segments by keys 232 and cause a shorter or longer spread of the segments. This will enable control over the initial length desired for our purpose, and its lengthening from this point.
3. A closed ring 234 adjustable by keys 236 enables modulating the movement of segments by creating a fixed limits of travel. Using both rings 234 it is possible to define fixed limits of travel for movement of cylinder handle 116. This will enable repetitive, accurate control over the length of movement developed by the segments and the pipe.

Sensors 198 assembled on this pipe, or on the rings 234 will enable the motor 194 assembled on the pipe to move the pipe and segments in fixed travel limits movement as per Figs. 16-18.

4. The pipe is shown adapted with elastic hose 192 to enable passage of vacuum material therethrough.

In Fig. 25, there is shown a pipe that having an internal movement mechanism, enabling passage of materials therethrough. This figure is an addition to Figs. 21, 22. The

possibilities in Fig. 21,22 exist here too, and the elastic pipe 192 enables the passage of vacuum materials therethrough, and can be adjusted for use with vacuum cleaners, spray painting equipment, other spraying actions, etc.

As shown in the initial position, segment 108 is enclosed in segment 106, and both are enclosed in segment 104. All the segments are hollow and nested one inside the other. One hand holds handle 114, attached to segment 106, and the other hand holds handle 116, attached to segment 104. When handle 114 is pushed away from handle 116, this causes segment 106 to emerge from segment 104, and to pull strap 240, which attached to segment 106 at connecting point 241.

Strap 240 moves on a metal rack 242, and turns on axles 243, 244 placed on it at openings 245,246. The metal rack 242 is attached to segment 104 at point 247, and it is positioned between segment 106 and 108. Strap 240 rotates around the axles of the metal rack 242, and is also attached at point 248 to segment 108, which moves in segment 106. When strap 240 rotates on its axles as segment 106 emerges, its rotation causes segment 108 to emerge from segment 106, because the strap is also attached to segment 108, at the connecting point 248. Segments 106, 108 emerge from one another by opposite movement, and at the same time they move and emerge from segment 104 in opposite directions. In this fashion, lengthening of the pipe is achieved, and by opposite motion, closing of the pipe is achieved.

An elastic hose 192 with the capability of stretching and shrinking, is attached to the edge of segment 108 at point 250, and at the other end, to segment 106 at point 255, and it

stretches and shrinks according to the movement of the segments. This hose makes it possible for materials to pass through it for different purposes.

The embodiment described in Fig. 25 can be applied for use with an external water hose connected at opening 257, and the water will flow through hose 192, and then through segment 108 and exit through opening 259. By extending or shrinking the pipe, flower plants may be watered without requiring bending or reaching motion. Another application is to connect the openings 257, 259 of the pipe at its ends to spraying or vacuuming equipment. This pipe can replace the fixed length vacuum cleaner tools which limit the ability to reach high places, and corners.

#### PIPE CARRYING STRAP

In Fig. 26, there is shown an embodiment in which the pipe is held by belts against a user's body, like a pipe for fruit picking. The pipe will be held at point 260 to shoulder belt 262, which is attached to the shoulders, and is hung on the belt at this point. While activating the pipe, it is possible to use one hand that will move the activating handle, while its end is attached at belt 262.

In the case of a motorized pipe, the activating hand can direct the pipe to the required direction, and the segments are moved by the motor. When not using the pipe, it can be placed in clamp 264 in belt 265, freeing the hands for other activities.

#### TELESCOPIC TAPE MEASURE

In Fig. 27a, there is shown another embodiment in an application for use in deploying a tape measure or flexible

meter. This can be assembled on one any of the pipes previously described, to enable a user to deploy the meter alone, without the need of another person to hold the other end of the meter. This is constructed as spring-like meter rolled up under spring tension, of the type builders, carpenters etc. use. Typically, such craftsmen measure distances and heights with another person holding the other end of the meter. By assembling the meter box at one end of the rod, and attaching the tape measure at the other end of the rod, one person can comfortably and efficiently perform the measurement. The meter can also be assembled inside the rod, and the measurement can be viewed through a window.

The meter can also be implemented on a guiding stick for the blind, by providing the measurement in Braille engraving on the tape measure, which the blind person can sense by touch, to know the distances around them. The rod itself can be calibrated with numbers/ <sup>277 (Fig. 27b)</sup> and it will function as a meter. The telescopic structure can be made of transparent plastic, with the meter inside of it, so the results are visible via the plastic.

In Fig. 27a, there is shown a measuring rod 270 with meter 272. The meter box 273 is mounted at one end of segment 108, and the starting end 274 of meter 272 connects to the other end of rod 270 at the end of segment 104. The measurement is performed by holding the meter box 273 with one hand, and pushing the second segment 106 left to open the rod segments up to the measured point. The measurement can be viewed by on the meter at point 276.

In Fig. 28, there is shown a measuring rod 278 that can be an internal meter 272, which is assembled in the rod 278. A



window 280 is provided for viewing the measurement. This application can also be implemented as a guiding stick for the blind, with the meter engraved with the calibrated measurements in Braille. These can be sensed by touch at the window. Activation of the rod is achieved by holding the handle 114 containing the meter box 273 with one hand, and extending the rod with the end 274 of the meter which is connected to the end of segment 108 at point 282. By pushing the handle 116 to the right, the rod segments 106, 108, will open for the measurement, with the result viewable at window 280. In a transparent rod, the measurement is viewable anywhere on the rod.

#### TELESCOPIC DRILL TOOL

In Fig. 29, a retractable and extendible telescopic pipe is shown having an internal cable 290. This embodiment is constructed such that cable 290 is rotatable within a sleeve 292 while extending or retracting pipe 294. Rollers 296 enable the movement of sleeve 292 containing the rotating cable 292, and the pipe segments will move sleeve 292 and rotating cable 290 both back and forth as needed. The left end of the cable can be attached to a rotatable clamp 297 positioned on the edge of the pipe and to drive rotation of different appliances attached to it such as a drill bit 298, a sharpening disc, screwcutter, hedge and grass trimmer with a spinning disc, etc.

The right end of cable 290 can be connected to a motor 194, which is located inside or external to handle 114. If mounted externally, motor 194 is arranged to slide on a track 299 via clamp 300. Switch 301 can be used to control motor 194

rotational speed.

#### ROTATING TELESCOPIC PIPE

In Fig. 30, a retractable and extendible telescopic pipe 302 is shown which rotates around itself. This pipe is constructed with roller bearings 304, 306 assembled, respectively, in handles 308, 310. Bearing rings 314, 316 which are attached to the pipe and rotate with pipe rotation, will rotate about bearings 304, 312. Handle 310 is movable at the same time back and forth on bearings 306 mounted underneath it. Movement of the pipe segments 104, 106 is guided by sliding members 318, 320 which move, respectively, within internal tracks 322, 324 formed in the pipe segments, in order to enable simultaneous rotation of the pipe and its segments. The rotation of the entire pipe is driven by a motor attached at nipple 326 formed at the end of the pipe.

To operate the pipe, one hand holds handle 308, and with the other hand moves handle 310, back and forth, causing the pipe segments 106, 108 to extend and retract.

#### TELESCOPIC BROOM

In Figs. 31a-b, 32 there is shown a telescopic pipe attached to a tool which is arranged to vary the angle of the tool. For example, the angle of a broom can be varied while using the pipe. The broom head 330 is connected to pipe 108 at axle 332. A cable 334 is attached at its right end by clamp 336, to the second segment 106 of the pipe, and at its left end to clamp 338 on broom 330. While the pipe segments extend and retract during the cleaning process, the direction of the bristles on the broom head 330 are flipped up and down (arrow A) cable 334 is stretched and released. As a result, the angle of

the broom head 330 and the bristles will change with shortening or lengthening of the pipe. Spring 340, or any other arrangement, will bring the broom head 330 to the initial state. Alternatively, angular control can be provided by a toothed wheel 339 which rotates broom head 330 by motion of rack 341 mounted on an 343 arm attached to the end of segment 106 (Fig. 32).

To simplify the movement of the sweeping action, the pipe can be provided with an adjustable width frame 342 (Fig. 31b) on wheels 344 which rotatably supports the broom head 330 on pins 347,349 during the sweeping action, raising it with each extension motion, and lowering it with each retraction motion. Thus, the need to lift the broom head 330 with each sweeping movement is avoided, since the pipe is pressed downwards during each retraction and cleaning motion and the pressure is released when extending the pipe in a new sweeping movement. Release of the pressure on the pipe, will cause springs 346 to raise the frame 342 upward, so that it passes over the floor with each pipe extension.

#### TELESCOPIC CAMERA TRIPOD

In Figs. 33a-c, one leg of a camera tripod is shown in various stages of deployment, by incorporating the telescopic elements of the present invention. The single leg is used to represent in simplified form a complete tripod assembly (Fig. 34).

The tripod leg 350 is attached to a base 352 for a camera, and to a main cylinder 354 via a support leg 356. The leg is attached at axle 358 to base 352 of the camera. The tripod leg 350 comprises segments which are provided as an upper leg 104, a middle leg 106, and a lower leg 108. A cylinder sleeve 360 is

slidably movable on main cylinder 354, and a fastening handle 362 attached to sleeve 360 locks it in position. A spring 364 surrounds cylinder 354 externally, and sleeve 360 maintains it under compression around cylinder 354. Segments 104, 106 and 108 have locking keys 366. A travel limiting stop 368 is provided to establish the correct angle for tripod leg 350 of the stand.

Support leg 356 is attached to sleeve 354 and extends through groove 369 formed along the upper leg segment 104. Support leg 356 is pivotable on axles 370, 372 at either end.

To open the tripod, fastening handle 362 is released by turning it upwards. Upon releasing it, spring 364 causes sleeve 360 to slide downwards on main cylinder 354. This causes middle leg segment 106 to emerge from upper leg segment 104, by action of support leg 356 which connects the sleeve 360 and middle leg segment 106. The lower leg segment 108 emerges from the middle leg segment by telescopic action according to one of the embodiments described previously, such as by using loop straps.

Upon lowering sleeve 360 to the bottom end of the main cylinder 354, the tripod leg 350 opens fully. By pulling the cylinder handle 362 back up, tripod leg 350 is pulled to the left and stops at an angle fixed by the angle brake 368. By lowering the fastening handle 362 and turning it left to the direction of the sleeve 360, the fastening handle 362 lock sleeves 360 on the main cylinder 354.

At this point, the user can fix the length of any one of the stands' legs and its balance, by pressing the stand toward the ground and locking keys 366 on the legs.

To close the tripod, the keys 366 are released, and

fastening handle 362 is released by turning it upwardly to the right. The fastening handle 362 is then held and the sleeve 360 is lowered, causing legs 350 to move toward the main cylinder 354, to become parallel to it (as in Fig. 33b). Then, the sleeve 360 is raised on main cylinder 354 against the tension in spring 364. This causes the leg segments to retract one inside another, and this also can be achieved by pressing the stand to the ground. Finally, fastening handle 362 is closed as well as one key 366.

Figs. 35a-b show an alternative embodiment where the support leg 356 is externally connected by clamp 371 to the middle leg segment 106. Fig. 36 shows a complete tripod assembly.

In Figs. 37a-c, another possibility of a camera stand construction is shown, featuring a camera tripod in which the tripod leg segments open and close in one movement. The difference here is that the wide part of the tripod leg (segment 104) is at the bottom, which provides more stability.

#### CAMERA TRIPOD - CENTRAL LOCKING SYSTEM

In Fig. 38, there is shown an articulated camera tripod which enables rapid deployment by unlocking and locking in one movement. With existing camera tripods, typically at least seven locking movements are required. By application of the telescopic system of the present invention, the legs of the tripod can be quickly opened in one movement, and the tripod can be balanced and adjusted to the desired state (by applying pressure from the top to the bottom). The legs can be locked in one locking movement, enabling TV photography crews to act much faster.

In Fig. 38, only one leg of the tripod is illustrated

for simplicity. Fig. 39 provides a detailed view of the locking mode. Generally, the locking principle of the tripod is similar to the way bicycle brakes operate, but in addition to the rubber brake there are toothed brakes that prevent the segment from slipping in and/or out.

After opening the leg 350 by separating it from the central axle 354, the tripod is balanced and adjusted and the extended segments are locked in position. Sleeve 360 slides on central axle 354, and a central brake handle 374 mounted on sleeve 360 is pressed downward and right in the direction of the arrow. A portion 375 of brake 374 is designed to press and lock sleeve 360 to central axle 354. Cables 376,377 are attached to brake handle 374, such that while locking, brake handle 374 pulls cables 376,377 backwards. Movement of cables 376, 377 in their respective sleeves 378, 379 pulls the arms of the respectively connected forceps brakes 380,381 and they close toward each other, like a bicycle brake.

Cables 376,377 are attached at one end to the brake handle 374 and at the other end, cable 376 is connected to the arm brake 380, and cable 377 to arm brake 381. When cables 376, 377 are pulled back, respective arm brakes 380, 381 close on leg segments 106,108 and on the toothed rails 382-385 that are formed with an angle as shown, which matches the toothed brakes 386,387 to prevent segments 106,108 from sliding in or out of each other, beyond the locking point.

To open the brakes, central brake handle 374 is elevated upwards and to the right, to release cables 376,377.

Their release will cause the arms of the brakes 380, 381 to become spaced apart from leg segments 106,108, by action of spring 388 (Fig. 40) which tends to open brake 380, 381 arms to the sides (as in a bicycle). An electronic cable 389 can be arranged in the tripod and provided with suitable plug connection points 390,391 for cable connection.

#### TELESCOPIC MUSIC STAND

In Figs. 40a-b, a three-legged music stand is shown incorporating the telescopic elements in accordance with the invention. These Figs. describe a mechanism which achieves simultaneous opening and closing of the music stand legs and a music sheet support easel. This embodiment implements the telescopic pipe principle described in connection with Fig. 1.

In the initial position, the telescopic pipe is in a closed state and the three legs attached are virtually closed. The stand can be opened by opening screw 392 on operating handle 116. Then handle 116 is moved along segment 104 to which are attached a flexible loop 118 and a base 394 connecting the three legs. By pushing the handle 116 downwards, the three legs 396 open downwards and this is because the small legs 398,399 are attached at their upper end to pivots 400,401 (positioned on handle 116) and connected at their bottom end to legs 402,403 at pivots 404,405. Pushing the handle 116 downwards causes the small legs 398,399 to convey the movement through the pivot connections to make the legs 401,402,403 open to the sides and then downwards until they reach the desired position to put the stand on the floor (Fig. 40b), and then opening/closing screw 392

is locked to complete the stand setup.

At the same time, while pushing handle 116 downwards and opening the legs 396 (402,403,404), the telescopic pipe 107 is extended, by motion of the flexible loop 118, attached to handle 116 at points 119. This loop is also connected to segment 106 at point 122, when it passes through holes 120 formed in the first segment 104. As the handle 116 is lowered downwards, loop 118 is pulled downwards, and second segment 106 emerges from the first segment 104, and the third segment 108 emerges from the second segment 106 by movement of loop 118. The music stand can be closed by motion of handle 116 in the direction opposite the opening direction.

#### TELESCOPIC UMBRELLA

In Fig. 41, there is shown a telescopic system of elements arranged to provide an umbrella. Typically, existing umbrellas are folded umbrellas or unfolded types. The common problem of these umbrellas is the fact that they operate in two states, i.e., a closed state when not in use or an open state. In the open state the umbrella diameter is not controllable but is fixed. Generally, umbrellas are problematic when subjected to strong winds that tend to fold or break the open umbrella. Another problem is that when walking in a busy street, an open umbrella often does not permit passage through certain places, so that it must be closed, and then reopened where space permits.

The umbrella embodiment shown in Fig. 41 enables the user to control its diameter when deployed. Where only a light rain is falling it can be opened to a half-diameter. In a pouring rain, it can be opened fully. While walking in a crowded area,



the diameter can be reduced without closing it, and still be protected from the rain. Similarly, if the winds are strong the diameter can be reduced, so that the umbrella will not be damaged. Thus, the inventive umbrella allows continuous control of the umbrella diameter according to changing situations. Only one leg of the umbrella embodiment is shown for simplicity.

As shown in Fig. 41, a side 406 of the umbrella is shown, comprising a main handling pipe 408, a handle bar 114, a sliding handle 116 movable along pipe 408, a cloth cover 410, a strap 412 for opening umbrella cover 410, and a strap 414 for closing umbrella cover 410. The umbrella cover 410 is attached over the three telescopic segments, first segment 416, second segment 418, and third segment 420. An expandable supporting leg 422 supports side 406 of the umbrella.

In operation, initially, umbrella side 406 is closed and the sliding handle 116 is close to and above handle 408. By pushing handle 116 upward on main handling pipe 408, the opening strap 412 (attached to sliding handle 116 at point 424) stretches. The opening strap 412 will move in the direction of the arrows according to the elevation of the sliding handle 116. Strap 412 moves through the lower hole 120 of the main pipe 408, along it upwards, exiting through the upper hole 120, and from there through the right hole 426 into the first segment 416 of the umbrella. Strap 412 is attached at point 428 to the edge of the second segment 418. Thus, by stretching strap 412 while elevating sliding handle 116, the second umbrella segment 418 will emerge from first segment 416, while the umbrella side 416 is raised into position.

Loop strap 430 is attached at point 432 to first segment 416 and at point 434 to third segment 420. It also passes through holes 436 on the second segment 418, and when second segment 418 moves, loop 430 causes the third segment 420 to emerge from the second segment 418, which simultaneously emerges from the first segment 416. When sliding handle 116 reaches the highest point along the main pipe 408, it stops against a notch 438 formed in main pipe 408. In this position, side 406 will be fully open, and the other sides of the umbrella will open simultaneously, supported by legs 422.

The supporting leg 422 is connected at its lower end to pivot 440 on the handle 116, and at its upper end to pivot 442 at the edge of the first segment 416, or at pivot 444 on second segment 418. Cover 410 of side 406 is connected to main pipe 408 at point 446 and moves with the segments, by attachment to first segment 416 at point 448, to second segment 418 at point 450, and to third segment 420 at point 452.

To close the umbrella, handle 116 is pulled downwards along the main pipe 408, causing the closing strap 414 (attached to the sliding handle 116 at point 454) to stretch and move downward with sliding handle 116. Closing strap 414 passes over a small pulley wheel 456 and into first segment 416, through hole 458 and from there is connected to the back end of the second segment 418 at point 428. Downward movement of strap 414 causes second segment 418 to enter first segment 416, and simultaneously third segment 420 enters second segment 418, since movement of second segment 418 backwards causes loop 430 to pull third

segment 420 inside as well.

The movement of the umbrella segments reduces the diameter of umbrella cover 410, which is attached to them. The lowering of sliding handle 116 causes supporting leg 422 to close towards the main pipe 408. When sliding handle 116 reaches the bottom end of main pipe 408, the umbrella is in a closed position.

It is possible to establish intermediate deployment states of the umbrella, and to cause the umbrella to open to any desirable diameter, with an appropriate spring-loaded latch 460 on handle 116, that will grip suitable notches 438 along the main pipe 408. Pulleys may be provided to reduce friction between the loops and the passages in the umbrella segments. The main pipe can be divided into two parts or provided as a telescopic pipe.

#### TELESCOPIC PARASOL

In Fig. 42, there is shown a parasol embodiment employing the telescopic pipe construction of the umbrella. Typically, existing large parasols are constructed of fixed length, and use heavy cloth or tarpaulin, with a large sweep, requiring them to be deployed from underneath the parasol, such that the user must assume a bending position, to open the parasol. When the user wishes to close the parasol, he must again assume the bending position inside the parasol, surrounded by the cloth, and he must then bend to crawl out. In large parasols over outdoor cafes, two people are needed to perform the opening and closing of the parasol, and many times things fall off the tables as a result of the sweeping movement of the cloth.

The only difference from the umbrella of Fig. 41 is that the parasol has a handle-bar 462 mounted on a gearwheel 464,

which is positioned on the sliding handle 116, and engages a toothed rail 466 mounted on main pipe 408. Raising the handle-bar 462 causes the gearheel 464 to rotate, and this drives movement of the movement handle 116 upwards as it rides on the toothed rail 466, and causes the opening of the parasol. As will be understood, opposite rotation of the handle-bar 462 reduces the parasol diameter until it closes when handle 462 reaches bottom.

It will be understood that the umbrella and parasol may be motorized, and the desired diameter can be established in the parasol, at any point. The inventive telescopic parasol can be opened and closed easily and efficiently by one person who can control the spreading to a desired diameter, and control its opening and closing. This is possible because the parasol is built from a few segments having a length which can be chosen. In this way, the diameter of the parasol can be fixed.

#### TELESCOPIC AWNING

In Fig. 43, there is shown a telescopic shade or awning constructed in accordance with the invention. Existing outdoor awnings over stores require many turning movements until the awning is fully open. Most of them have a handle-bar connected to a gearwheel mounted on a pipe, which conveys the turning motion of the handle-bar to drive the opening and closing of the awning. Closing the awning also requires many turning movements.

As shown in Fig. 43, the inventive awning operates similarly in many ways to the action principle of the umbrella and the parasol. The differences are that instead of an opening and closing strap, the awning is provided with a chain 468

attached to handle-bar 462 and gearwheel 464. When the handle-bar rotates clockwise, it causes chain 468 to rotate clockwise driving rotation of gearwheel 470, which is mounted on an axle in first segment 416. Gearwheel 470 is attached to a long pipe 472 that connects to a second gearwheel 474 on the first segment of the parallel side 478.

As gearwheel 470 is driven with clockwise rotation, this causes rotation of pipe 472 and the second gearwheel 474 attached to it. Rotation of the two gearwheels together, clockwise, moves the toothed rails 480, 482 attached to them, causing second segment 418 to emerge from first segment 416. Simultaneously, segment 430 emerges from segment 418, as they are attached to loops 430, as described with respect to the telescopic umbrella.

Cloth 410 is connected between the telescopic segments 416, 418 and 420 and is stretched between sides 406, as described previously, at points 446-448, 450, 452 and the simultaneous opening or closing of the segments causes the awning to open or close, when handle-bar 462 turns in the desired direction. If needed, support legs 422 can be provided to raise the awning as with the umbrella embodiment. Alternatively, the awning is fixed in place and only the second and third segments emerge and enter the first segment. As will be understood, this embodiment can also be motorized.

Advantages of the inventive awning include the ability to open it with a few rotation movements, using handle-bar 462, or in one movement providing it is activated with an opening and closing loop used with a curtain, as described further herein.

This enables the user to open or close the awning quickly, easily and with less effort. The Fig. 42 parasol embodiment can be adapted for use with the awning, with appropriate modifications.

#### MOTION MULTIPLIER FOR CURTAIN SYSTEM

In Figs. 44a-d, there is shown an extendible facility device for surfaces, curtains, shutters, fabric surfaces and the like. Existing curtain systems include continuous long curtains, curtains assembled in separate units with the ability to move on their axles in the desired angle, etc. With these systems, a drawstring is used to spread the curtains open, and the same string is pulled in the opposite direction, to close the curtains. Another way is to hold an end of the curtain and pull it to the desired position, or in the opposite way to close the curtain. In the opening and closing actions described, the drawstring is pulled several times until the curtain is fully spread/closed.

In Fig. 44a, a motion multiplier system for a curtain is shown in an initial, open state. This figure does not include the four tracks in which the four segments move, since they appear in Fig. 44b, which is a view from above Fig. 44a. In this figure, curtain 490 is attached to conventional plastic hooks 492 which slide in curtain track 494.

An opening/closing loop 496 is attached to the back end of a second segment 418, at point 498, and the loop passes through a hole 500 formed on the permanently fixed segment 416. A pulley wheel can be mounted in hole 500 to reduce friction during movement of the loop. From the connection point 498 the loop

returns and passes over pulley 502 until it is attached back on itself and to form a complete loop.

To close the curtain, when the left side of loop 496 is pulled, segment 418 is also pulled, as it is connected at point 498. Segment 418 has holes 504 formed in it, and when segment 418 is pulled back, loop 506 is stretched. Loop 506 passes through holes 504 and is attached at one portion thereof to the fixed segment 416, at point 508. At the other side of loop 506, it is attached to the back end of the third segment 420 at point 510.

When the second segment 418 is pulled back, loop 506 pulls back segment 420, which moves backwards in its track. Loop 512 passes through holes 514 formed in third segment 420 and is attached at one portion thereof to the edge of segment 418 at point 516. At the other side of loop 512, it is attached to the back end of the fourth segment 421 at point 518.

When the third segment 420 is pulled back, loop 512 pulls the fourth segment 421 backwards in its track. This pulling action will happen simultaneously and all segments will move in their tracks until reaching a position parallel to each other, and in the position of the fixed segment 416.

Each of the moving segments 418,420,421 has a respective connection point 520,522,524 that is connected via rings 526,528,530 to the curtain at points 532,534,536. Rings 526,528,530 move along track 494, and while sliding back will sweep the plastic hooks 492 that are connected to curtain 490, and in this way the curtain will move and close backwards in one pulling movement of the pulling loop 496.

To open the curtain, the right side of loop 496 is

pulled downwards, which causes a telescopic action that will open the curtain by sliding movement of the segments forward in their tracks, and in the opposite direction upon closing the curtain.

The curtain movement system can be adapted for use with moving doors, surfaces and shutters, by creating a parallel, double system that moves together with two segment columns as described in the embodiment showing the telescopic awning. Then, the shutters, surfaces and doors can be moved on their tracks.

In Fig. 44b, tracks 538,540,542 are shown from a top view. In Figs. 44c-d, respectively, side and perspective view of tracks 538,540,542 are shown, in a reverse orientation such that holes 500,504,514 and loops 496, 506, 512 of the segments are shown projecting above tracks 538,540,542, for purposes of clarity of illustration. In actual installation, the orientation of tracks 538,540,542 is downward. Fig. 44d also illustrates the second segment 418, showing pulley wheels 544, 546 mounted on either side to prevent friction and facilitate sliding of the segment inside its track 538.

In Fig. 45a, three segments are shown with the curtain in a closed position. As shown in Fig. 45b, when the segments are open, they become arranged one after another in the tracks 538,540,542 to form a straight line, unlike in Fig. 44, where they are organized parallel to each other when they are opened. In Figs. 45a-b, pulleys 550,552,554,556 are used instead of holes to guide the opening and closing loops. In addition, loop 506 is connected to the first and third segments at points 558, 560.

The innovation in the curtain movement system of Figs.



44a-d is that a user can open/close the described curtain in one pulling movement (or several, depending on the curtains' length). With the appropriate changes, the curtain movement system can be motorized, and will operate as with the telescopic awning system.

With the appropriate changes in orientation of the opening and closing loop and the layout of the segments vertically, a new type of vertical shutter can be developed. A double and parallel system of segments is required, with the tracks arranged on each side of the shutter, and the shutters will connect as shown in the awning construction of Fig. 43.

#### MOTION MULTIPLIER FOR CONVEYOR SYSTEM

In Fig. 46, a telescopic conveyor system is shown, constructed in accordance with the present invention. Existing conveyor and material handling systems require movement over their full length, powered by a motorized transmission system that conveys a surface from point A to point B. This requires a lot of time and many motor rotations, is complicated and costly.

The inventive telescopic conveyor system shown in Fig. 46 is constructed on the same principle as the awning and shutter movement system described in Figs. 43-45. The conveyor system is built with double and parallel transmission of segments and tracks 538, 540, and driven by hand power (Fig. 46) or motor power (Fig. 47). The segments 418, 420 will be conveyed quickly from the loading point (Fig. 46a - closed state) to the unloading station (Fig. 46b - opened state). The segments 418, 420 are loaded with cargo 600, and in this way cargo 600 is transferred quickly to the desired place, while saving energy. A cargo

forklift can be positioned above tracks 538,540 and will not bump into them, or move in them.

In Fig. 47, an alternative embodiment of the telescopic conveyor system is shown. Here, motors 602,604 are used instead of the pulleys 550,554. The chains 506,512 forming the opening and closing loops are respectively connected at points 612,614 which are at the rear end of the second and fourth segments. An electric pulse controls the operation of motors 602,604 simultaneously and will cause the segments to move until their closing/opening point.

A suitable track can be arranged for motors 602,604 which move together with the segments. Transmission of the control pulse to motors 602,604 can be provided in a direct manner through electric rails provided in the tracks, via an electric shoe which makes direct contact with the electric rails along the tracks. In this way, motors 602,604 are powered by the control pulse and appropriate sensors operate with motors 602,604 and are positioned so as to limit segment movement, as described previously in regard to Figs. 16-18 showing a pipe with sensors.

As will be understood, it is possible arrange the chains of the conveyor/handling system to any required direction, to provide layer on layer of segments positioned in their tracks, one above the other, as the chains and motors convey the movement between them, generated by a single electric pulse. These multiple layers of segments can be arranged one on the other in their tracks, and when a pulse is generated, or one pulling movement, they will all open at once as a result of transporting

the movement created by the chains and the motors.

This innovative conveyor/handling system permits moving cargoes a lot faster and in a shorter time. Such a novel handling system can be implemented in elevators, moving staircases etc.

#### TELESCOPIC FACILITY DEVICE

In Figs. 48-51, there are shown embodiments of a telescopic facility device attached to the wall and/or the ceiling, for convenient movement of appliances and control panels. This system will influence life at home, at the office and the like, and has the potential of introducing a new lifestyle. In the currently accepted home layouts, in order to operate different appliances one has to reach each one of them and activate the appliance, e.g. to watch TV - one has to sit where the TV is placed.

Most of the appliances at home are connected to wires, cables etc. lying around the house. In addition, their position is dependent on the position of the sockets in the room. Appliances such as faxes, telephones, answering machines need both an electric socket and a telephone socket. Appliances such as TV, video, cable TV, each need an electric socket and another special receiving socket. Thus, corners of many rooms are full of appliances, not always in a comfortable position, with plenty of wires and the like.

When cleaning is done, the usual implements used are a vacuum cleaner and/or water, rag, broom, floor sweeper, ladder, window sweeper, pipe for cleaning dust and cob webs, etc. All of these cleaning activities are performed in an uncomfortable way, e.g., by dragging the vacuum cleaner around, carrying buckets of

water, mopping the water on the floor.

The inventive facility device will enable many improvements and innovations in different fields, and can develop a new lifestyle in the home, office etc. It is adaptable to the latest technologies like: flat TV screens, a remote control for all house hold appliances, computer control on appliances, operating systems through the phone, TV phone etc. This device enables a user to operate and work from anywhere desired. The user can watch TV, operate a computer, or talk on the phone from anywhere in the room. This is possible because the device has sockets for every purpose, control panel, microphone, camera, screen, and a lamp. All of these control the appliances placed in a separate area, while the user operating them can be seated anywhere in the room, as the device is positioned near him and allows operation of the appliances that are elsewhere.

For cleaning operations, the device has an elastic hose system for water flow, and vacuuming is possible. An elastic tube can be attached to the device and connected to a multi-purpose pipe that does cleaning - vacuuming, washing floors, and the fluids flow through the pipe and into the device, and from there, through pipes, to a collecting point.

The device also enables home security operations, enabling, via a telephone from a distant place, to see what is happening in the house through the video camera on the device, that can move in a way that will enable viewing everything and even interfere in situations like fires, burglary etc.

The device can light the house everywhere desired. A

fan can be attached to the device, or a heating lamp, and the device will operate the appliances above the user. It is possible to position an electric socket on the device, and to connect to it from anywhere in the room without wires lying around on the floor, or telephone connection. The user can sit anywhere and listen to music from megaphones on the device by remote control.

In Fig. 48, an embodiment of the telescopic facility device is shown attached to the ceiling or elsewhere in a room. The facility device can be positioned in a comfortable place for a person who wants to watch TV, with a flat TV screen mounted on it. In this position, the person can enjoy air conditioning, lighting, a stand for a book, writing surface etc., mounted on it.

In Fig. 49, there is shown an embodiment of the facility device configured for cleaning the room by attaching a multiple purpose pipe rod 704 through which materials can pass. This rod is attached through an elastic external tube 706 to a suitable opening 708, enabling connection of different tools to the telescopic rod 700 by use of a clamp 710 to lock it. While vacuum cleaning, for example, the dust will be vacuumed into the pipe (or an elastic tube underneath it), and from there will continue to an elastic tube 706 that is connected to the internal elastic tubes (not shown) inside the telescopic rod 700, and from there will continue through tube 712 in the wall, until it reaches a collecting place 714 of the dust. The pipe can be used to sprinkle water, vacuum dust and water for cleaning purposes etc. The rod 704, and its connection to telescopic rod 700 enables comfortable work without dragging the vacuum cleaner, the cables, water etc.

In Fig. 50, an embodiment of the facility device is shown configured for window cleaning and as in Fig. 49, dirt can pass through the multiple purpose rod 700 to a suitable collecting place 714.

In Fig. 51, an embodiment of the facility device is shown configured with permanent appliances supported on the telescopic rod 700. In addition, a construction of a movement system 716 is shown for movement of telescopic rod 700 and the facility device above it for use in a large room. Other appliances are also shown supported by telescopic rod 700. In telescopic rod 700 are wires 718 that pass from the top end to the mounting surface 720 of the facility device 724, and from the other side is a wire 722 to the appliances the user wants to operate. The appliances can be easily activated and their position at the edge of the facility device 724 enables easy utilization anywhere in the room: Examples of possible appliances are:

1. table lamp and lampshade 726
2. electric, computer, telephone etc. socket panel 728
3. remote control 730, for monitoring movements of the telescopic rod 700 and its different functions, user holding remote control;
4. flat screen 732, that displays what the user wants: TV, computer, telephone with vision option, etc.
5. microphone 734 and video camera 736 so the user can talk to and see who is calling him, or transmit vocal orders to the computer, pictures through the video camera, etc.

It will be appreciated that assembly and disassembly of

different appliances from the mounting surface 720 of the telescopic facility device, and their replacement if needed, can be easily achieved, like connecting an electric oven and positioning it where it is needed, writing stand, food tray, etc.

Also shown in Fig. 51 is a movement system for the facility device, constructed by connecting the upper part of the device to a connecting point in the ceiling or elsewhere. The telescopic facility device can be turned around on track 738 and the supporting pipe 740 adds additional support. Pulleys 742 enable movement between the round track 738 and the pair of straight tracks 744 above them, and this enables rotation of the telescopic facility device in 360 degrees, and movement of the round track 738 along the pair of tracks 744. This makes possible the movement of the whole device to the right and to the left along tracks 744 as seen in Fig. 51. The pair of straight tracks 744 are connected to a round channel 746 above them, and pulleys 748 move inside the channel to enable rotation of the pair of tracks 744 and all of the device underneath them in 360 degrees. This feature also enables tracks 744 to rotate at ninety degrees to the orientation in Fig. 51, plus forward/backward motion.

In Fig. 52, an embodiment of the telescopic facility device is shown, revealing further construction details and degrees of freedom of movement of the device itself. The facility device comprises a mounting surface 720 which is attached at pivot 746 to segment 748.

The second and middle segment 750 can be moved in and out of the first segment 752 and also can be rotated around itself by virtue of a ring 754 positioned at the edge of the

first segment 752 at its lower end. Ring 754 enables a spinning movement of segment 750 around itself, and forward and backward movement. This is possible by attaching loop 756 to ring 754 at point 758, and then passing it through holes 760, 762 formed in segment 750. Loop 756 is attached to the end of segment 748 at point 764. A clamp 766 enables ring 754 to be fixed in position on segment 752.

The third and lower segment 748 of telescopic rod 700 is movable in and out of the second and middle segment 750. The third segment 748 also rotates with second segment 750. The first segment 752 of the facility can be rotated vertically on pivot 768 connected to it.

The lower supporting segment 770 connected at axle 772 to the top end of the first segment 752 can move telescopically within the upper supporting segment 774. The upper supporting segment 774 is connected at axle 776 to an upper sliding ring 778 which enables right angle bending of the upper supporting segment. The upper sliding ring 778 rotates 360 degrees around the top base 780 and enables full rotation of 360 degrees on telescopic rod 700 and the supporting rod 774 attached to it from the back.

The connecting segment 782 that connects telescopic rod 700 to the top base 780 at pivot 768 can rotate a full 360 degrees in the top base 780 and is placed vertically in the top base 780. The top base 780 is attached to a connecting plate 784 which is fixed to the ceiling or elsewhere by bolts 786. The telescopic rod 700 can be removed from plate 784 (above top base 780) and it can be connected to another connecting plate in the room.



The necessary wiring and cabling to telescopic rod 700 is connected via connecting plate 784, which has provisions for this. To place the telescopic facility device in its position as shown in Fig. 52, handle 788, which is spring-loaded under spring 790, is used to stretch cable 792, which is attached thereto. The other end of cable 792 reaches latch 796 in the second segment 750. When moved, spring-loaded latch 796 unlocks itself from a circular notch 794 formed in the inner diameter of the segments. At the same time, cable 792 releases the spring-loaded latch 796 of the lower segment 770 which is mounted in the top supporting segment 774. Release of spring-loaded latches 796 enables shortening or elongation of telescopic rod 700, or angular adjustment, 360 degree rotation thereof, or rotation of the two lower segments 748, 750 of the telescopic rod 700.

Release of the handle 788 causes latches 796 to lock onto the new notch 794 at the new position selected, with the desired length and angle. Pushing handle 798 against spring 800 causes stretching of cable 802, which releases spring-loaded latch 804 from grooves 806 formed in the connecting segment 808. When latch 804 is released, telescopic rod 700 and the connecting segment 808 attached to it can be moved vertically. Releasing handle 798 causes cable 802 to be released and latch 804 grips notches 806 in the new position selected for the desired height.

In Fig. 51, there are shown utility connection boxes on both sides of the room, for connection to the power supply, communication and control. On the right side of the room, box 810 is for power for vacuum cleaning, box 812 is for power for air

conditioning (cooling and heating), box 814 is the collection place for dust water etc., box 816 is the electricity panel, box 818 is for a communications center - telephone, answering machine, fax, modem etc., box 820 is for hearing devices- radio tape, etc., box 822 is for TV, video, cable etc., box 824 is for security devices- smoke detector, sirens etc., box 826 is for computer, hard disk, accessories and a control program that controls all the boxes and enables the remote in the user hands to select the right function. On the left side of the room, box 828 is for water supply, box 830 is for gas supply, box 832 is for fire extinguisher. The wiring and/or pipe system connected to each of these boxes is installed in the house wall, out of sight, and is connected to connecting plate 784 in the ceiling, and from there connects to an elastic tube and wiring system in the telescopic rod 700, and from there to mounting surface 720 of telescopic rod 700.

In telescopic rod 700, there are placed wiring and elastic hoses to connect from the top base 780 of the telescopic rod 700, to the other end thereof at mounting surface 720, where the socket panel 728 and remote control 730 are located. A connecting clamp 710 enables the desired accessory to be connected at mounting surface 720 (e.g. lamp). The pipes and wiring are arranged such that their length is adjustable to position telescopic rod 700 in any length, angle or desired place.

The excess length of the elastic hose and wiring will be primarily in the top segment 752 of telescopic rod 700, thus the rod may be shortened or lengthened by virtue of the excess.

It will be appreciated that the remote control 730 on mounting surface 720 can be removed and controlled by the user, and other remotes are located on the wall at points 834, 836 to enable control over telescopic rod 700 and attached devices.

In addition, telescopic rod 700 motion can be motorized, with motors positioned to enable the movement of telescopic rod 700 anywhere, in any angle and desired position.

#### TELESCOPIC WIND INSTRUMENT

In Fig. 53, there is shown a telescopic wind instrument embodiment constructed in accordance with the present invention. Existing wind instruments such as trombones require a large range of movement of the sliding portion to cover the range of music notes. The embodiment of Fig. 53 enables shorter movements of the hand of the musician, without loss of the range of music notes.

The telescopic trombone 838 is constructed of three segments, the mouthpiece 840, intermediate segment 842 and the horn segment 844. In the mouthpiece segment 840, a handle 846 is provided to hold the instrument, and the intermediate segment is provided with a handle 848 which enables sliding movement on the mouthpiece segment 840. In accordance with the invention, the instrument is equipped with a loop arranged such that the horn segment emerges from the intermediate segment in telescopic fashion by pushing apart and return motion of the handles 846, 848. It will be understood that new wind instruments and fingering systems can be adapted to operate with the telescopic principle of the invention (see Figs 10-15).

#### TELESCOPIC PERCUSSION INSTRUMENT

In Fig. 54, there is shown a novel telescopic

congas/bongo drum 850. In existing drums, only a single range of tones can be produced, except in the tympany drum, which enables stretching of the drumskin, to produce a range of tones. Using the telescopic principle of the present invention will enable a telescopic drum 850 to be designed, which changes the size of the resonance cavity to achieve a large range of tones.

As shown in Fig. 54, the telescopic drum is constructed with three segments 852, 854 and 856 connected between them in accordance with the inventive telescopic principle (see Figs. 10-15). A set of legs 858-860, 862 is provided to support the upper segment 852. A foot pedal 864 is connected to the lower end of the intermediate segment 854, and is arranged to lower its height against the tension of spring 866, which tends to raise it to its initial height. As the drummer beats on the drumskin 868, he can control the tones developed by depressing and releasing foot pedal 864, since this causes motion of the segments and changes the size of the resonant cavity. Other arrangements of the foot pedal and telescopic segments (see Figs. 7-9) can be provided to reduce the foot movement needed to make these resonant cavity changes, and other percussion instruments can be designed in accordance with this telescopic principle.

#### TELESCOPIC ILLUMINATION SYSTEM

In Fig. 55, there is shown a telescopic illumination system 870, featuring a telescopic light such as a fluorescent lamp arranged to be extendible in accordance with the inventive principle, to provide a variable intensity of illumination.

## TELESCOPIC SAILBOAT MAST

In Fig. 56, there is shown a sailboat 900 with a telescopic mast 902 constructed in accordance with the principles of the present invention. In existing sailboats, adjustment of the sails is a difficult procedure, and only limited maneuvers are possible.

As shown in Fig. 56, the novel telescopic mast 902 is constructed to enable quick and easy opening and closing of the sails, to improve control of the sailboat speed and navigation. The mast is constructed of three segments 904, 906 and 908, each having rollers arranged to enable smooth and balanced movement within one another. The first segment 904 is attached to the sailboat, the second segment 906 is arranged to slide therein, and the third segment 908 is arranged to slide within the second segment 906. A loop is attached to the first segment 904 at point 912, and passes through holes 914 formed in the second segment 906, and is attached to the third segment 908 at point 916.

A lifting arm 918 is connected to the top of second segment 906 at point 918, and is of sufficient length for the user to reach it by handle 920. While sailing, the user can control the height of the sails by raising or lowering the lifting arm 918, causing the telescopic mast 902 to move vertically, and opening the sails 922, 924, which are normally wound around the posts 926, 928, under tension of spring 930, 932. When a particular height of the sails is reached, a clamp 934 on posts 926, 928 prevents the posts from rotating and releasing the sails.

In an alternative embodiment, the mast remains fixed in

height, and is fitted with the curtain deployment system of Fig. 43,44 adapted for use with sails.

In addition to the telescopic mast, Fig. 56 shows a telescopic oar 936 which can be constructed in accordance with the principles of the invention, to enable telescopic movement.

In Fig. 57, a telescopic sailboat mast 902 is shown for construction on an existing sailboat mast 940, in removable fashion.

It will be understood that the telescopic system for multiplying movement in accordance with the present invention may be applied to many other embodiments in a large variety of fields, and these are contemplated as being within the scope of the invention.

Having described the invention with regard to certain specific embodiments thereof, it is to be understood that the description is not meant to be a limitation, since further modifications may now suggest themselves to those skilled in the art, and it is intended to cover such modification as fall within the scope of the appended claims.

## WHAT IS CLAIMED IS:

1. A motion transmission and multiplication system comprising:
  - at least first and second elements extending in the same orientation; and
  - at least a first means linking said first and second elements and being movable with respect to at least one of them, said first linking means being arranged on said first element such that when said first linking means is provided with a driving motion in a direction of said orientation, said first and second elements are provided with a driven motion with respect to each other.
2. The system of claim 1 wherein said driving motion is in the same direction as said driven motion of said second element.
3. The system of claim 1 wherein said driving motion is in the opposite direction of said driven motion of said second element.
4. The system of claim 1 wherein said driving motion is provided by hand motion of said linking means with respect to an end of either of said first and second elements.
5. The system of claim 1 wherein said second element is nested within said first element and arranged for telescopically-driven motion therein, said first linking means comprising a flexible loop attached at a posterior portion of said second element and arranged such that said driving motion is loop-type on said first element, to provide said telescopically-driven motion.

6. The system of claim 5 further comprising an elastic hose connected internally between said first and second elements to enable flow of materials between input and output ends thereof.

7. The system of claim 6 further comprising a speed control element associated with said first and second elements for operating an apparatus in relation to said driven motion.

8. The system of claim 5 further comprising a third element nested within said second element and arranged for telescopically-driven motion therein, said third element being linked to said first element by a second linking means comprising a second flexible loop being attached at a posterior portion of said third element and being arranged such that said driving motion is loop-type on said second element, to provide said telescopically-driven motion of said third element.

9. The system of claim 1 wherein said second element is nested within said first element and arranged for telescopically-driven motion therein, said first linking means comprising a first rack arranged such that said driving motion is of a sliding-type on said first element, said first rack engaging a pinion gear rotatably supported at an anterior portion of said first element, a gearwheel coaxial with said pinion gear engaging a second rack mounted on said second element such that said sliding-type driving motion of said first rack on said first element provides said telescopically-driven motion.

10. The system of claim 9 wherein a gear ratio between said



pinion gear and gearwheel fixes said telescopically-driven motion.

11. The system of claim 1 wherein said second element is nested within said first element and arranged for telescopic motion therein, said first linking means comprising a toothed flexible loop arranged such that said driving motion is of a loop-type on said first element, said toothed loop engaging a pinion gear rotatably supported at an anterior portion of said first element, a gearwheel coaxial with said pinion gear engaging a second rack mounted on said second element such that said loop-type driving motion of said toothed flexible loop on said first element provides said telescopically-driven motion.

12. The system of claim 11 further comprising a motor connected to said gearwheel for driving said loop-type motion.

13. The system of claim 1 wherein said second element is nested within said first element and arranged for telescopically-driven motion therein, said first linking means comprising a first rigid arm attached at an anterior portion of said second element and arranged such that said driving motion is of a sliding-type on said first element, to provide said second element with said telescopically-driven motion.

14. The system of claim 13 further comprising a third element nested within said second element and arranged for telescopically-driven motion therein, and second and third linking means, said second linking means developing driven motion in response to said driving motion of said first linking means, said third linking means developing driven motion in

response to said driven motion of said second linking means, to provide said telescopically-driven motion of said third element.

15. The system of claim 14 wherein said second linking means comprises a flexible loop arranged for loop-type motion on said first rigid arm, and said third linking means comprises a second rigid arm arranged for sliding-type motion on said first rigid arm, said loop being attached to an anterior portion of said first element, said second rigid arm being attached between said loop and said third element.

16. The system of claim 1 wherein said first element is a first rigid arm and said second element is a second rigid arm which slides thereon, said first rigid arm having a flexible loop arranged for loop-type driving motion between its ends, said second rigid arm being attached at a posterior end to said flexible loop such that when said loop-type driving motion is provided, said second rigid arm is provided with driven motion.

17. The system of claim 16 provided as a kit for self-assembly and attachment to a set of elements to be nested one within another for providing telescopically-driven motion.

18. The system of claim 16 further comprising a set of first, second and third elements nested within one another and arranged for telescopically-driven motion between them, said first rigid arm being arranged for sliding-type driving motion on said first element, and being attached to an anterior portion of said second element, said flexible loop being attached to said

first element, and said second rigid arm being attached to said third element to provide said telescopically-driven motion.

19. The system of claim 18 adapted for use with nested vacuum cleaner rods arranged for telescopically-driven motion.

20. The system of claim 19 further comprising an expandable elastic tube within said vacuum cleaner rods for suction transfer.

21. The system of claim 19 further comprising an expandable elastic tube external to said vacuum cleaner rods for suction transfer.

22. The system of claim 19 further comprising an elastic sleeve around said rod elements to maintain a dust/dirt barrier.

23. The system of claim 1 further comprising a motorized screw and a third element nested within said second element and arranged for telescopically-driven motion therein, said motorized screw being arranged such that said driving motion is screw-type on said second element, to provide said third element with said telescopically-driven motion.

24. The system of claim 23 further comprising limit switches mounted at least one of said elements for electrically controlling said screw-type driving motion.

25. The system of claim 1 further comprising a central element disposed proximate said first and second elements, said central element having an element slidably mounted thereon and being connected to provide sliding-type driving motion to said

first linking means.

26. The system of claim 25 adapted for use with a tripod having a plurality of legs each pivotable at an end of said central element and being arranged for said telescopically-driven motion.

27. The system of claim 25 adapted for use with a music stand having a plurality of legs each pivotable at an end of said central element and being arranged for said telescopically-driven motion.

28. The system of claim 25 adapted for use with an umbrella which opens and closes with said driven motion.

29. The system of claim 25 adapted for use with a parasol which opens and closes with said driven motion.

30. The system of claim 25 further comprising a second central element and a second set of first and second elements, all being spaced apart from said central element, adapted for use with an awning, which opens and closes with said driven motion.

31. The system of claim 1 further comprising a third element nested within said second element and arranged for telescopically-driven motion therein, said third element being linked to said first element by a spring-loaded tape tending to telescopically close said first, second and third elements together, said spring-loaded tape being calibrated with measurements such that driving motion of said first linking means provides said spring-loaded tape with telescopically-driven

motion to enable distance measurement.

32. The system of claim 1 adapted for use with a tape measure.

33. The system of claim 1 further comprising a tool attached proximate at least one end of one of said first and second elements.

34. The system of claim 33 wherein said tool is a drill and said first and second elements are rotatable about a common axis.

35. The system of claim 33 further comprising control means for determining a working angle of said tool angle in relation to said driven motion of said first and second elements.

36. The system of claim 1 wherein said linking means is enclosed within at least one of said first and second elements.

37. The system of claim 1 wherein said first and second elements are rotatable about a common axis.

38. The system of claim 1 wherein said first and second elements are movable side-by-side in tracks disposed adjacent one another.

39. The system of claim 38 adapted for use with curtains, which opens and closes with said driven motion.

40. The system of claim 38 adapted for use with shutters, which open and close with said driven motion.

41. The system of claim 38 further comprising rollers mounted at the ends of said first and second elements for guiding said movement in said tracks.

42. The system of claim 38 adapted for use as a conveyor, which opens and closes with said driven motion and which has cargo placed anywhere on at least one of said first and second elements.

43. The system of claim 1 adapted for use as a wind instrument.

44. The system of claim 1 adapted for use as a percussion instrument.

45. The system of claim 1 adapted for use with illumination.

46. The system of claim 1 adapted for use on a sailboat mast.

47. The system of claim 1 adapted for use as an assembly toy.

48. The system of claim 1 wherein either of said first and second elements has mounted at an end thereof a surface for supporting at least one of a tool and an electrical device for telecommunications, control, home entertainment and the like, with flexible wiring, cable, tubes and the like, being extendible during motion of said first and second elements, at least one of said first and second elements being supported overhead in a room to enable positioning of said surface at a desired position.

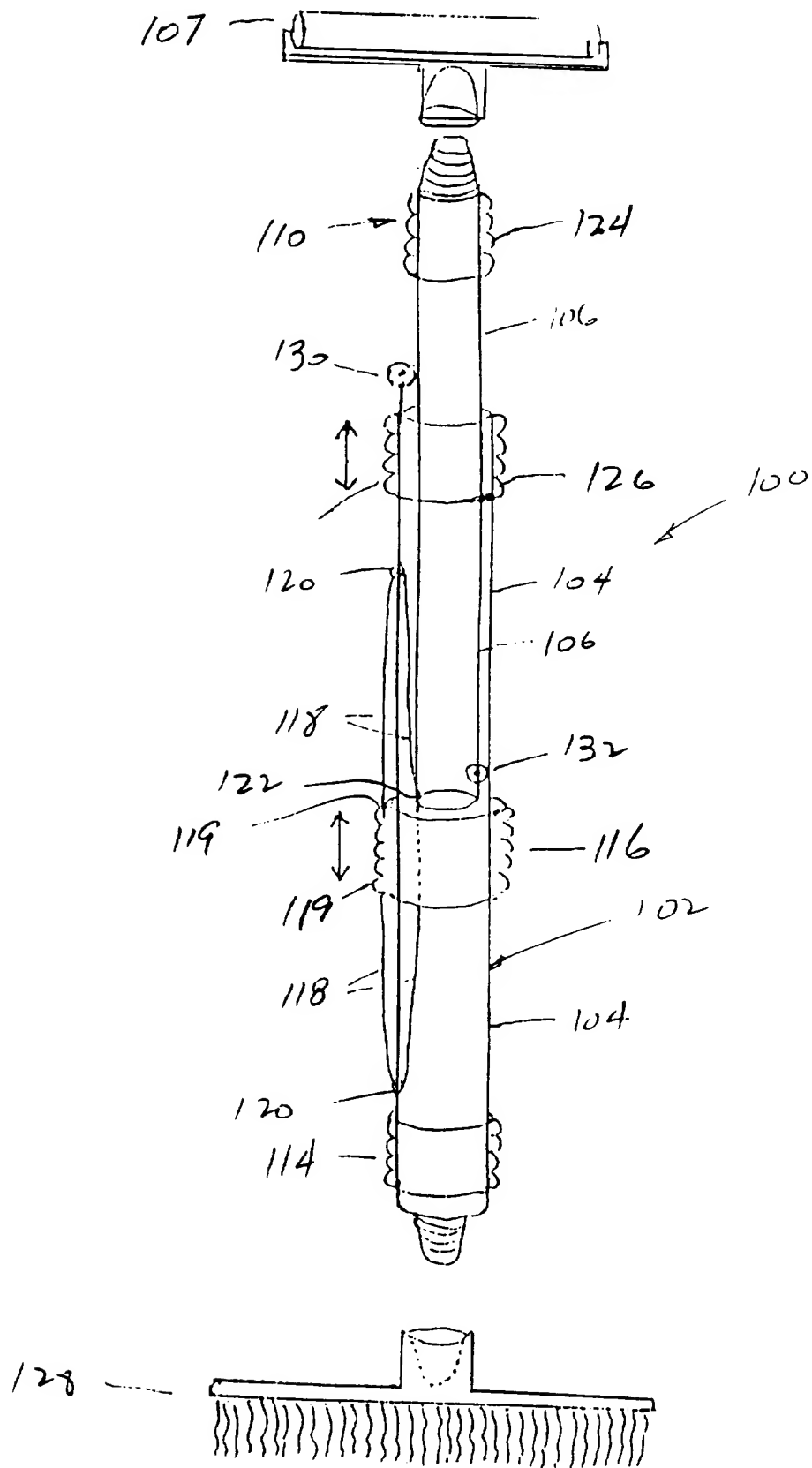


FIG. 1

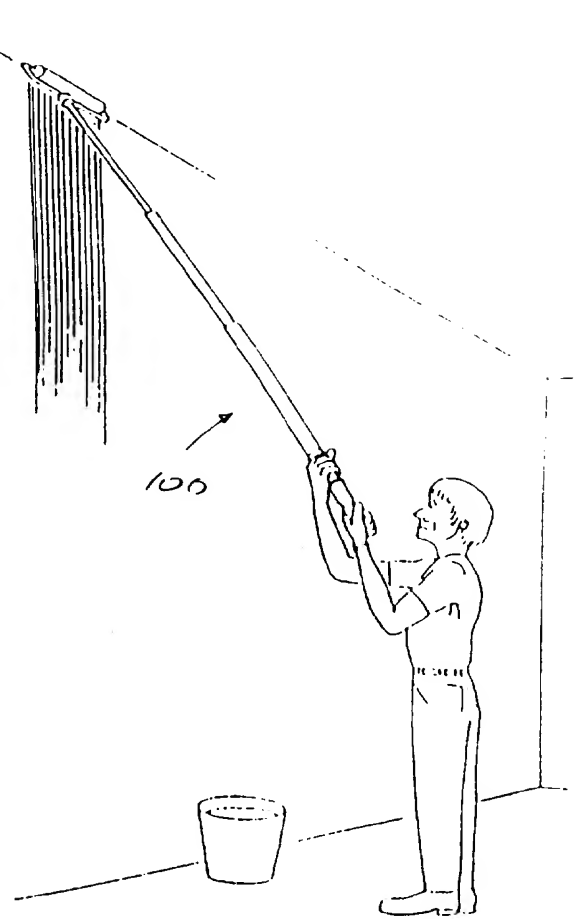
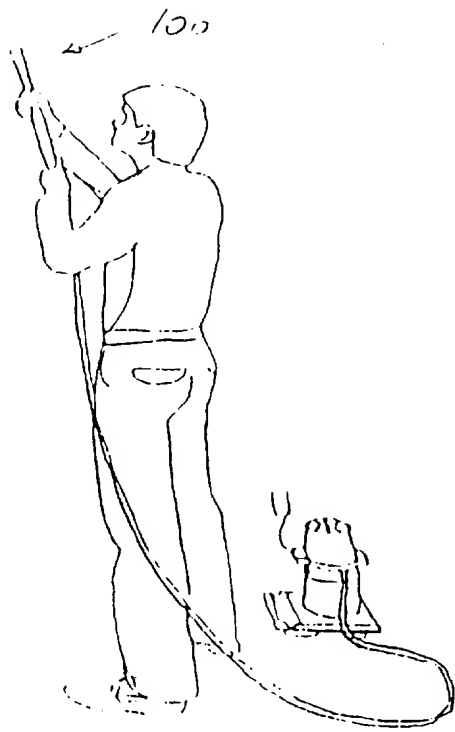
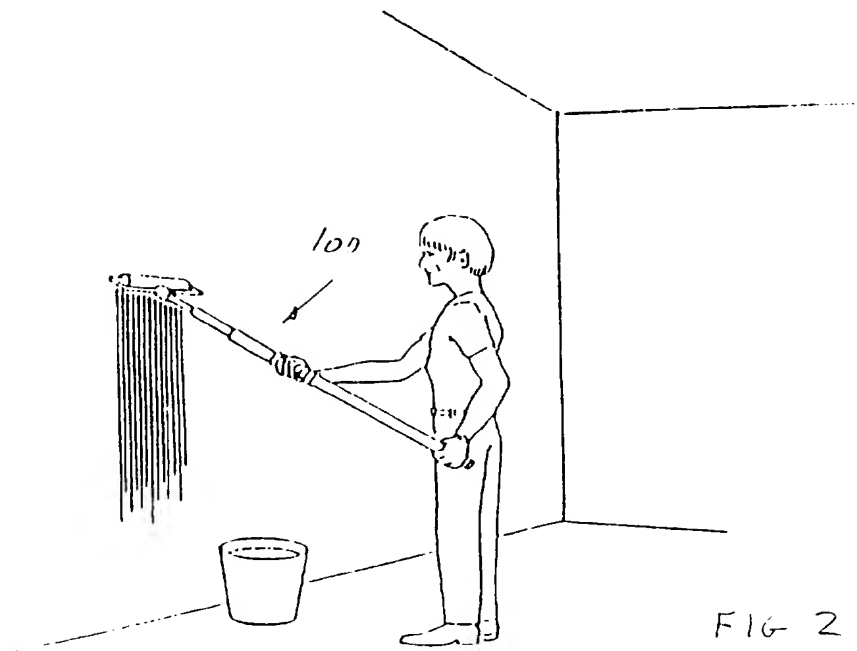






FIG 5

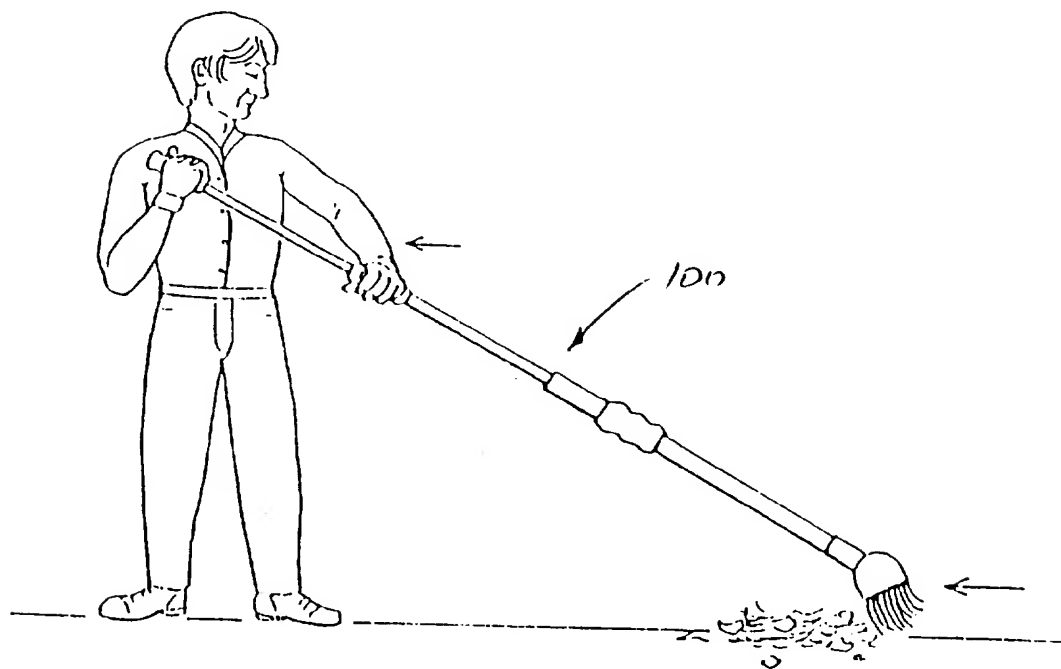


FIG 6

FIG. 7

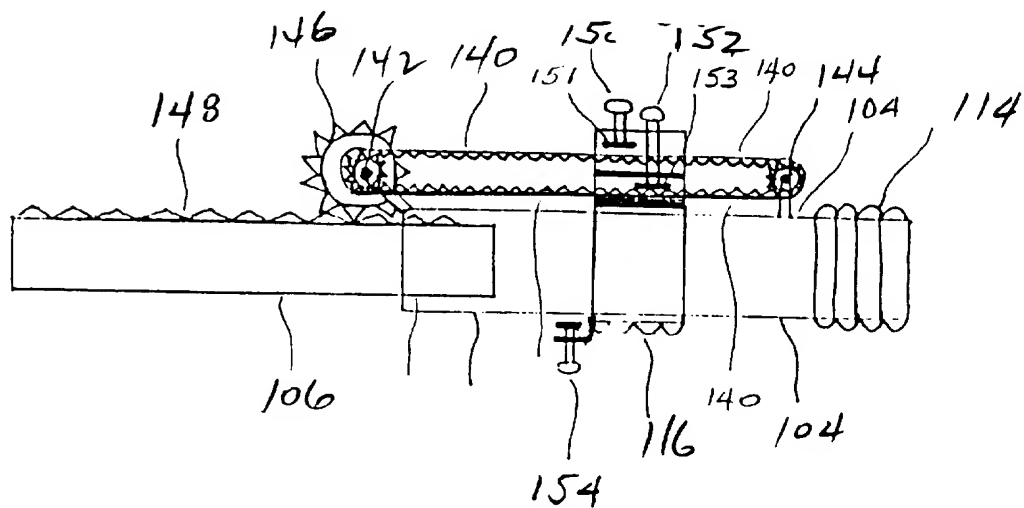


FIG 8

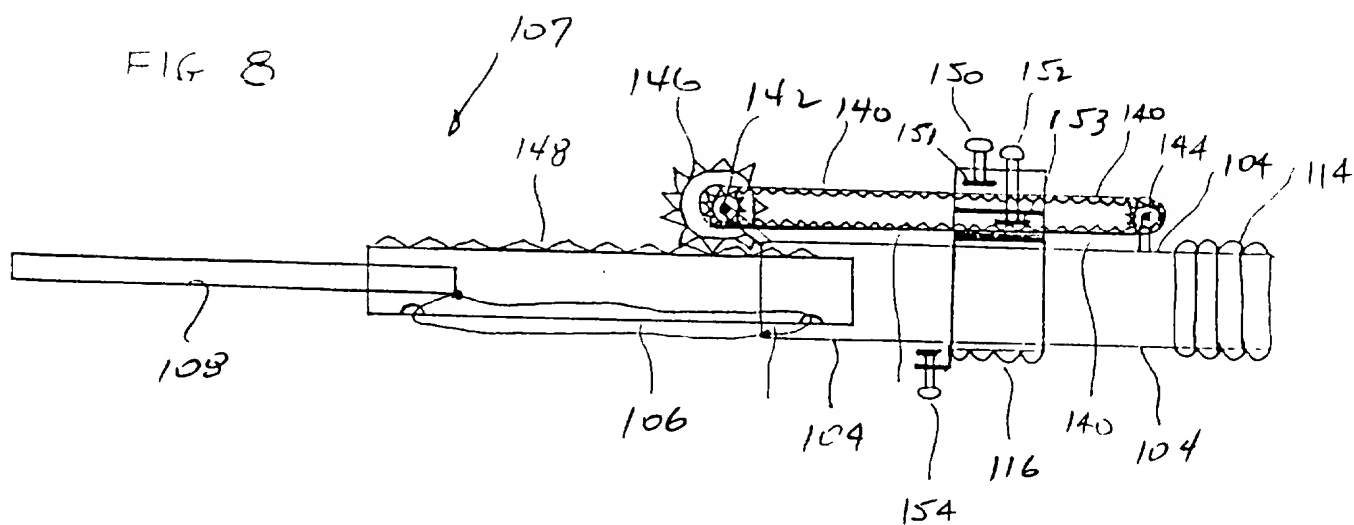
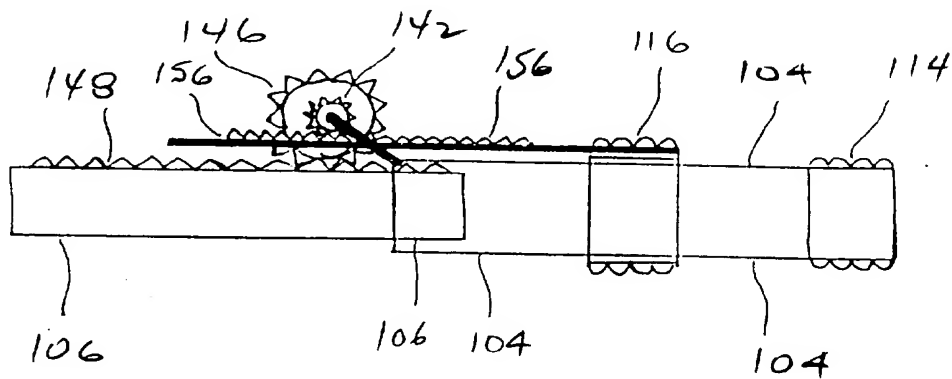
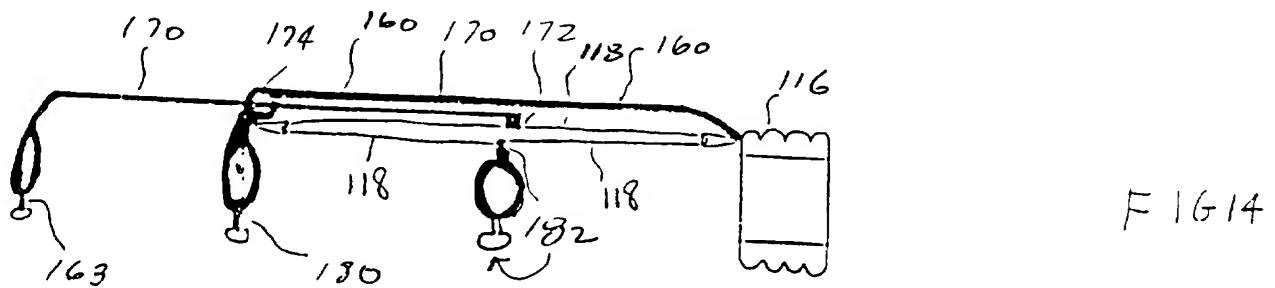
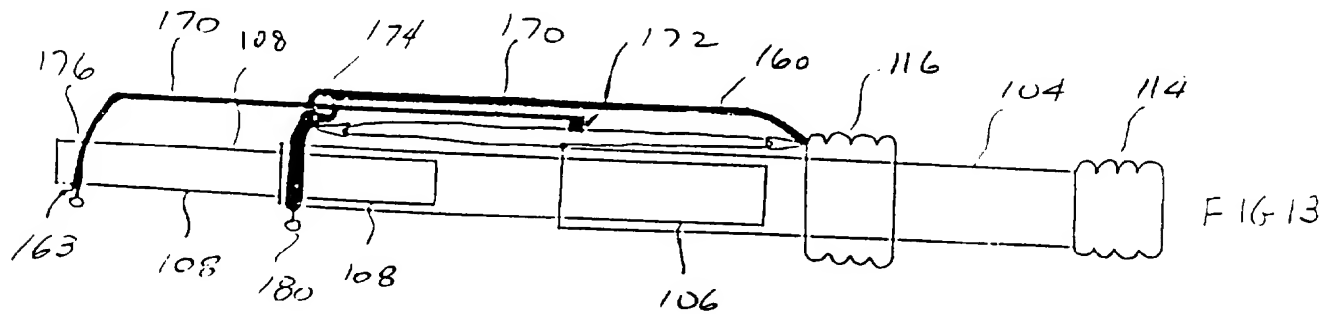
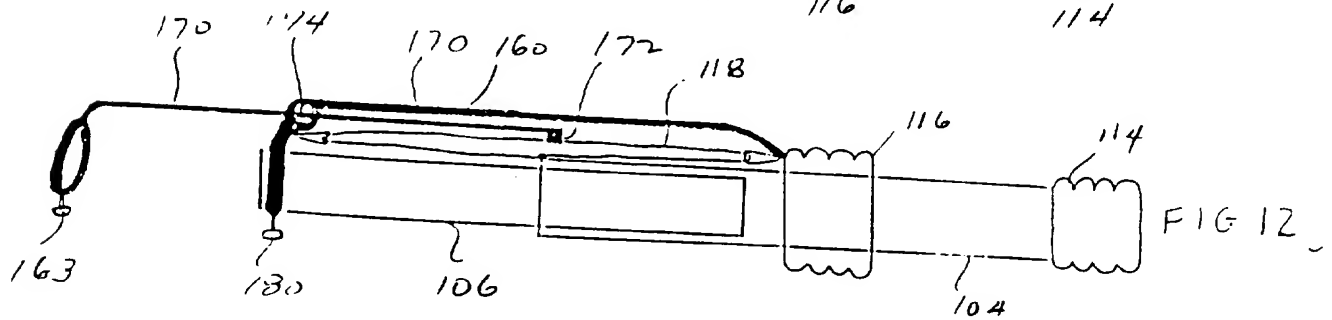
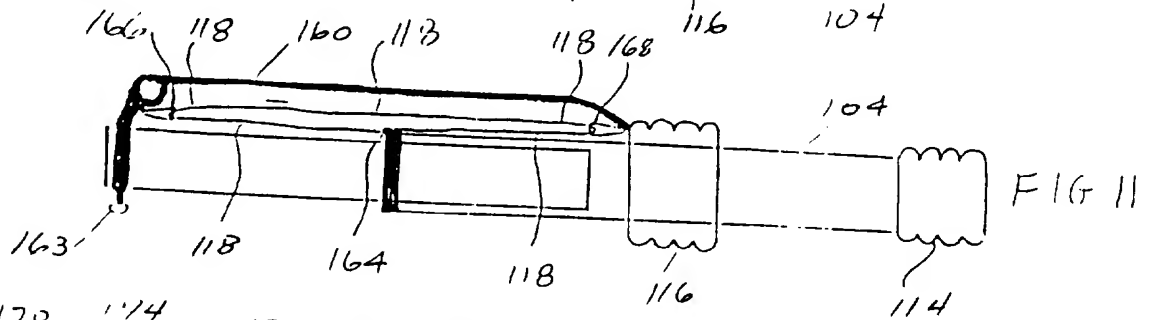
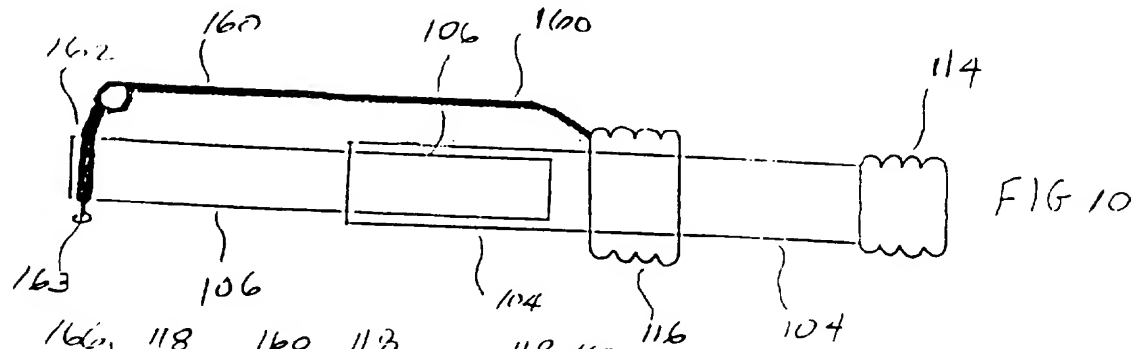


FIG 9





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FIG 15A

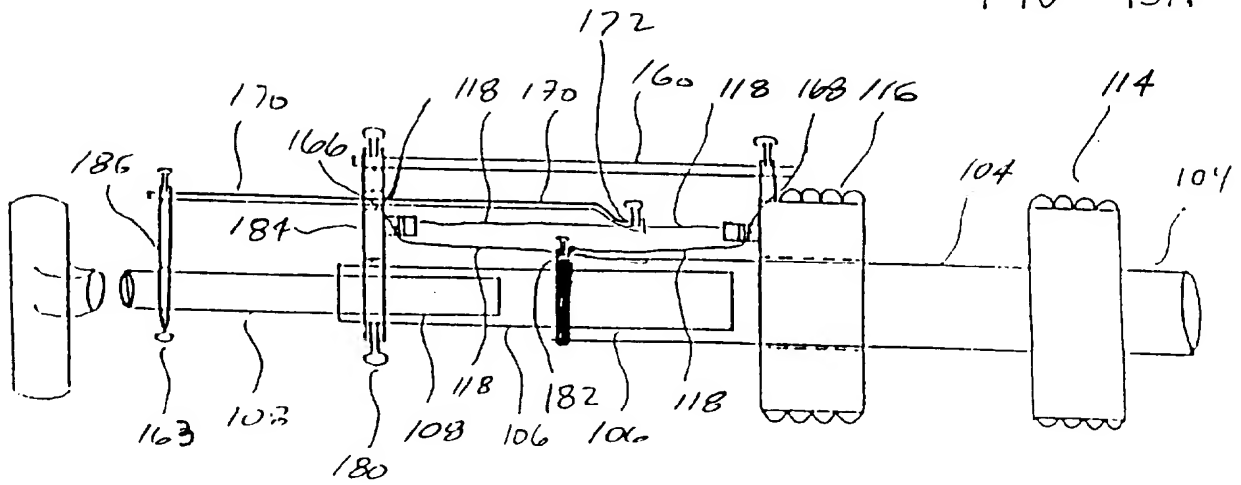
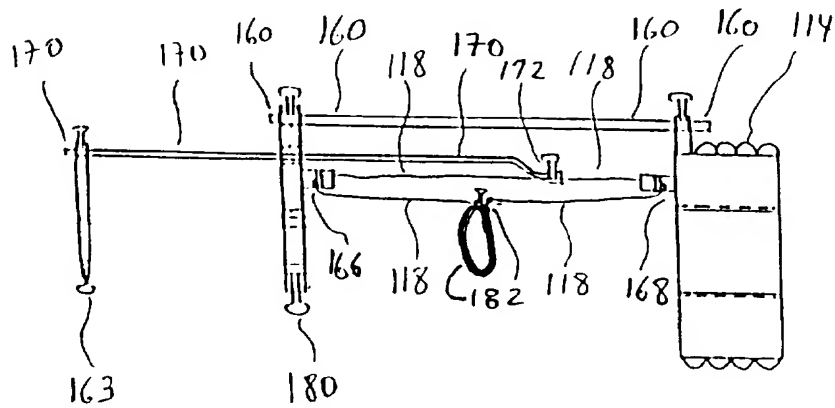


FIG 15B



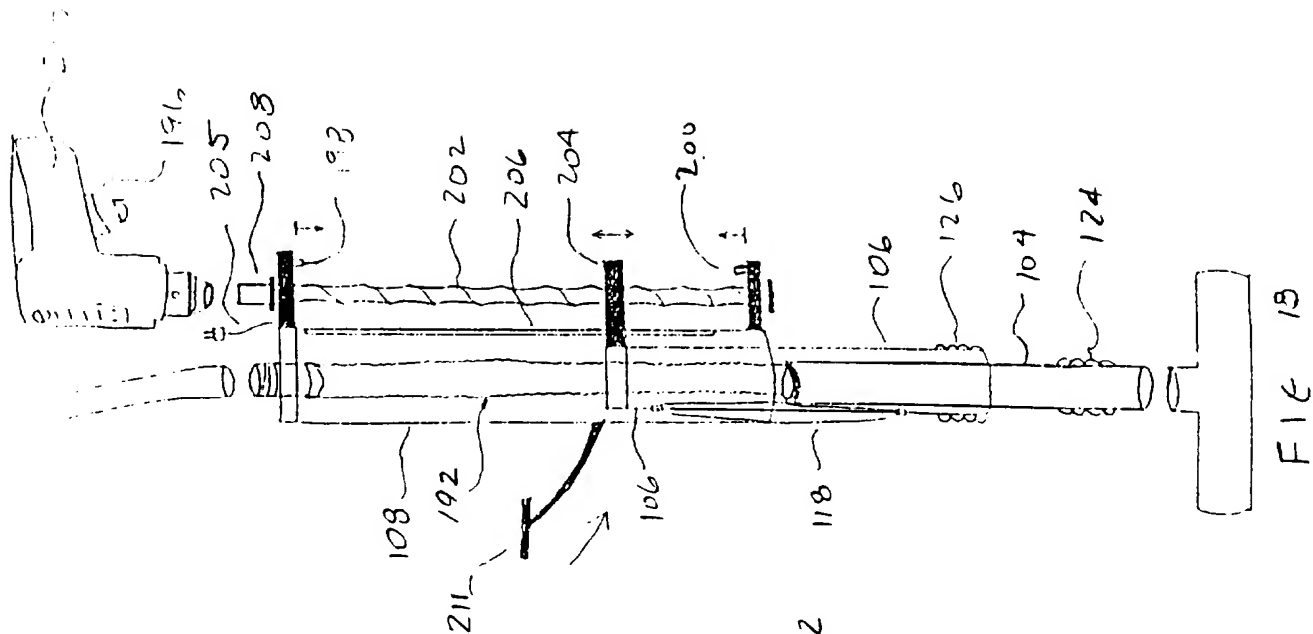


FIG 15

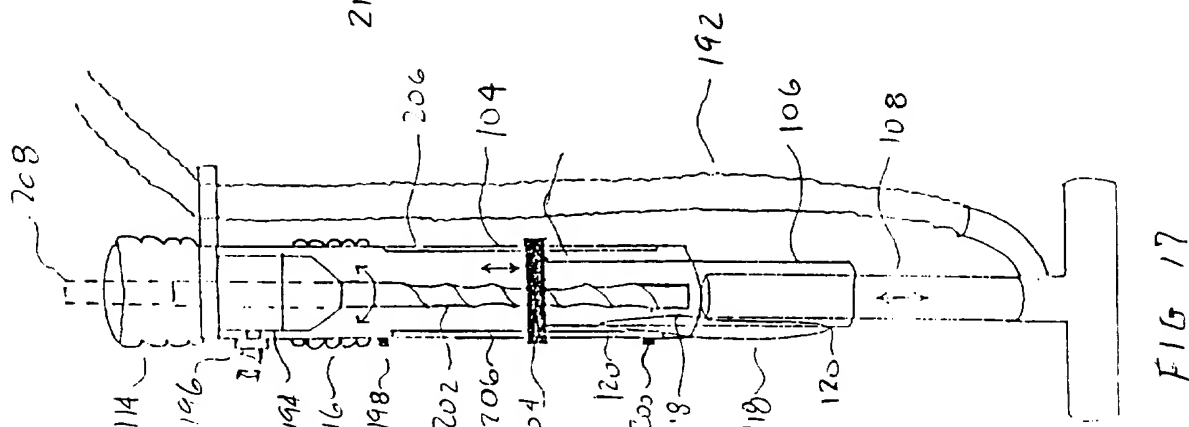


FIG 17

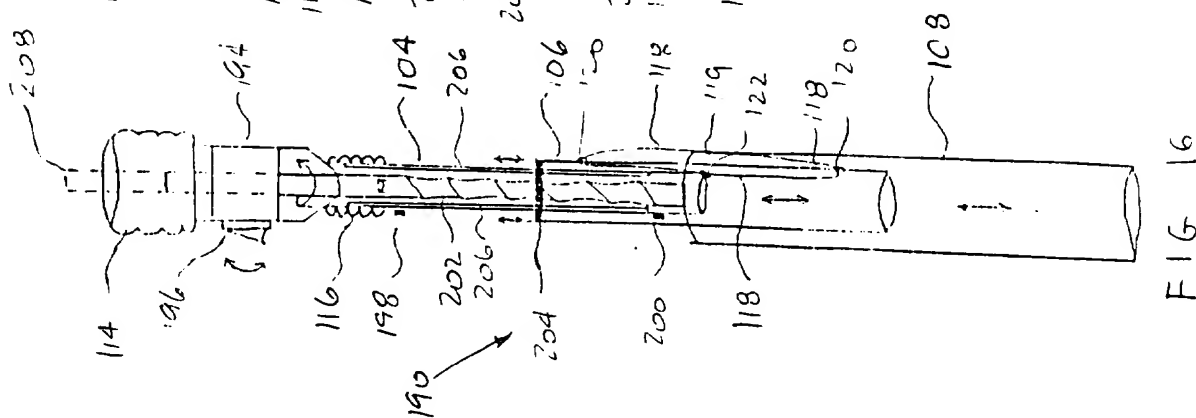
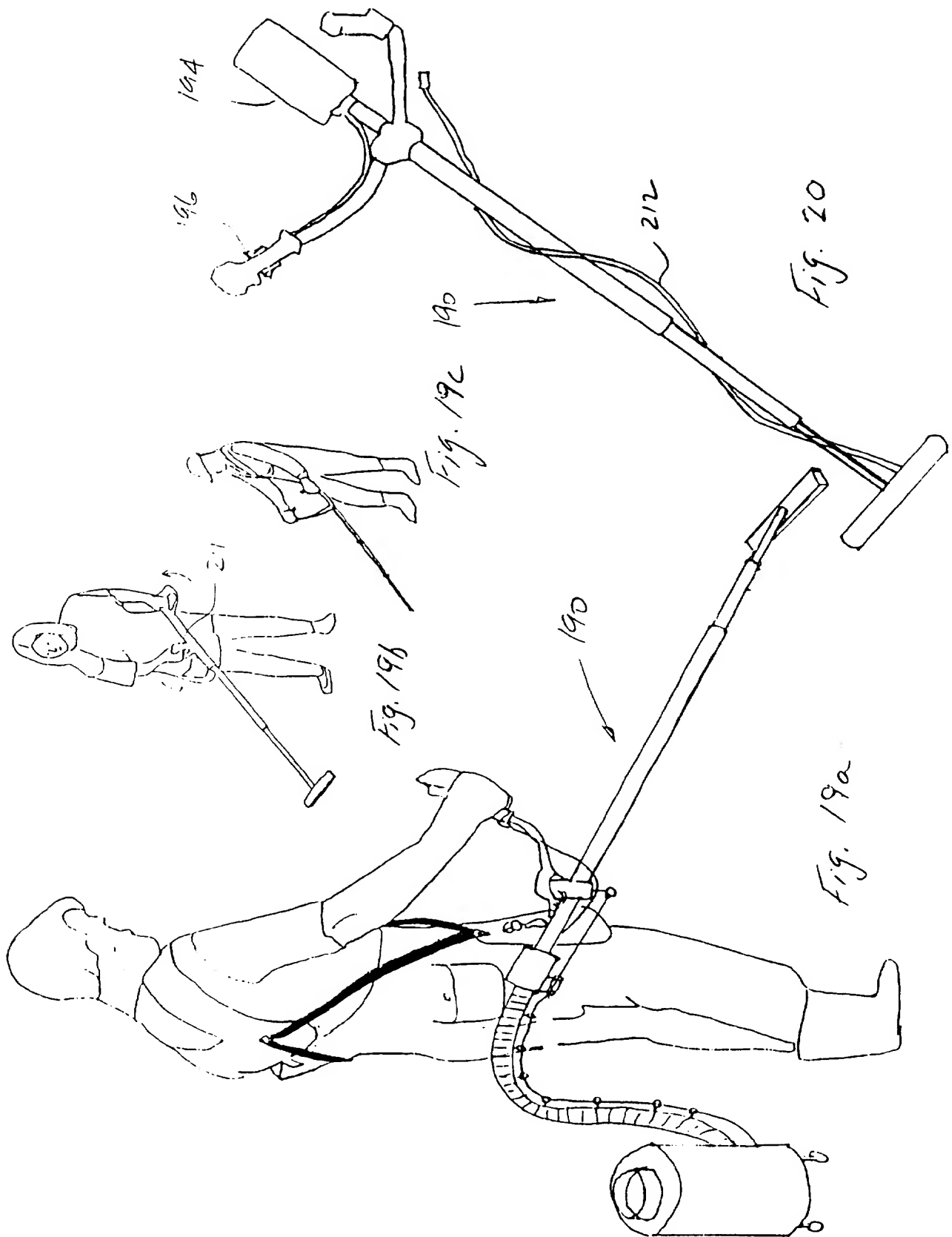


FIG 16



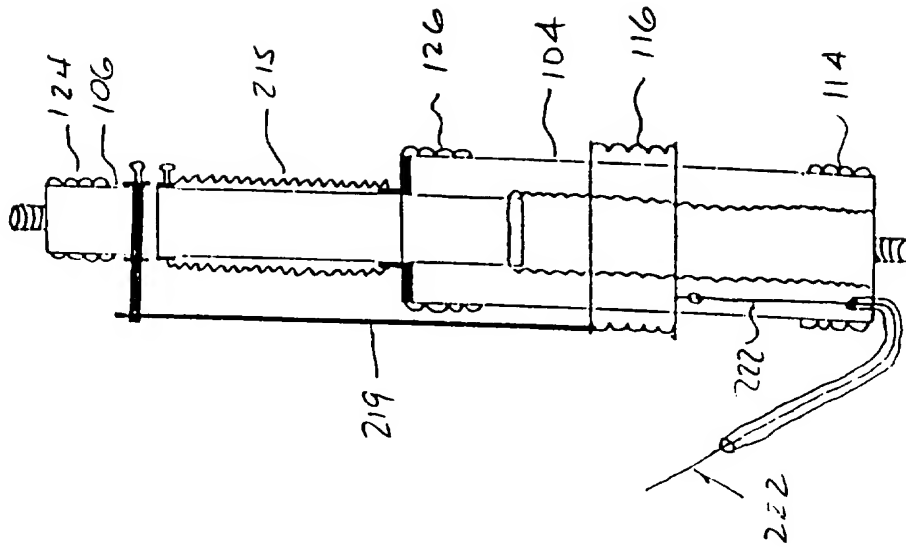


FIG 22

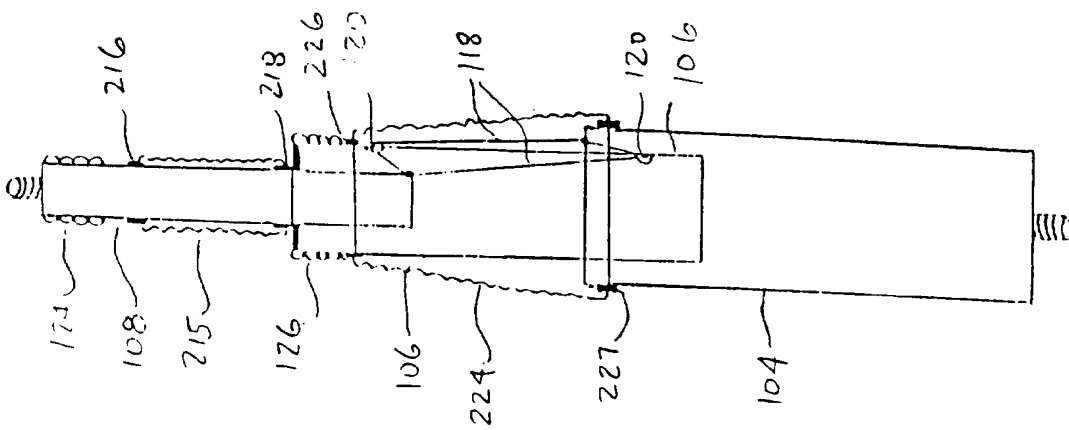


FIG 23

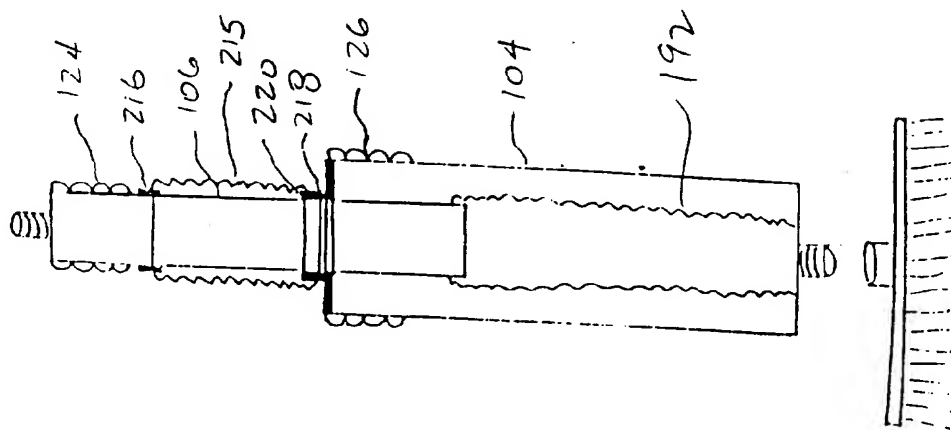


FIG 21





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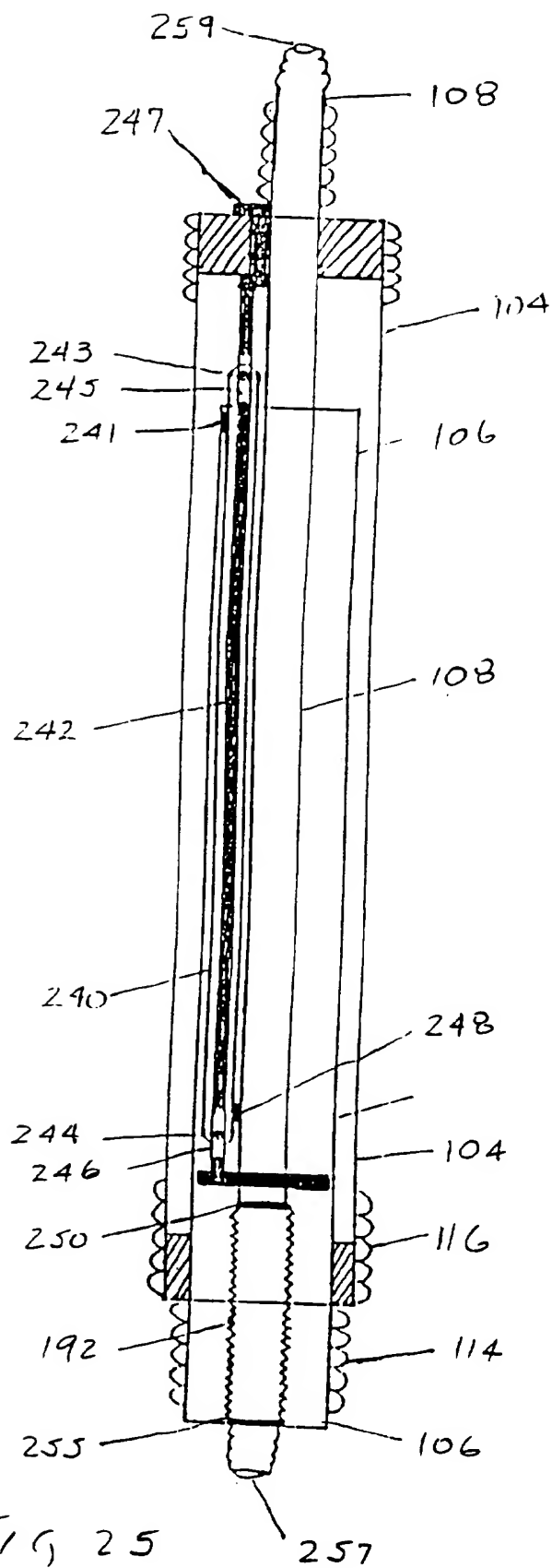


FIG. 25

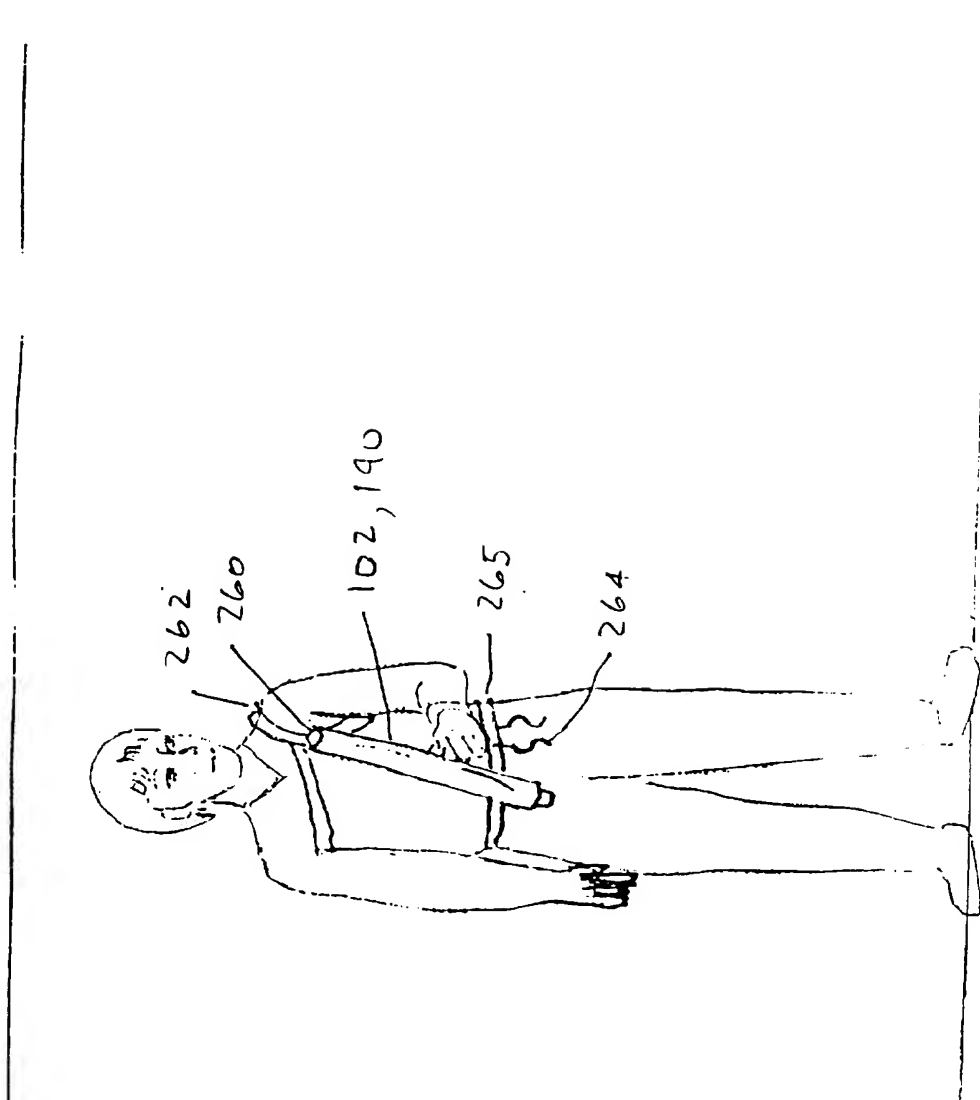
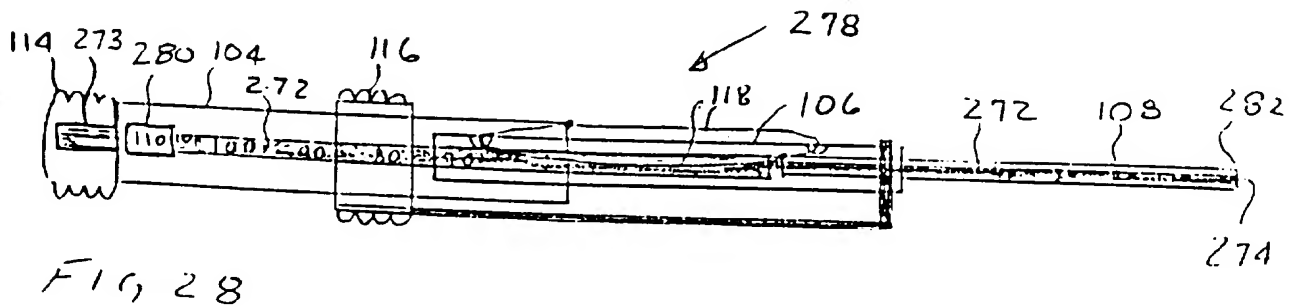
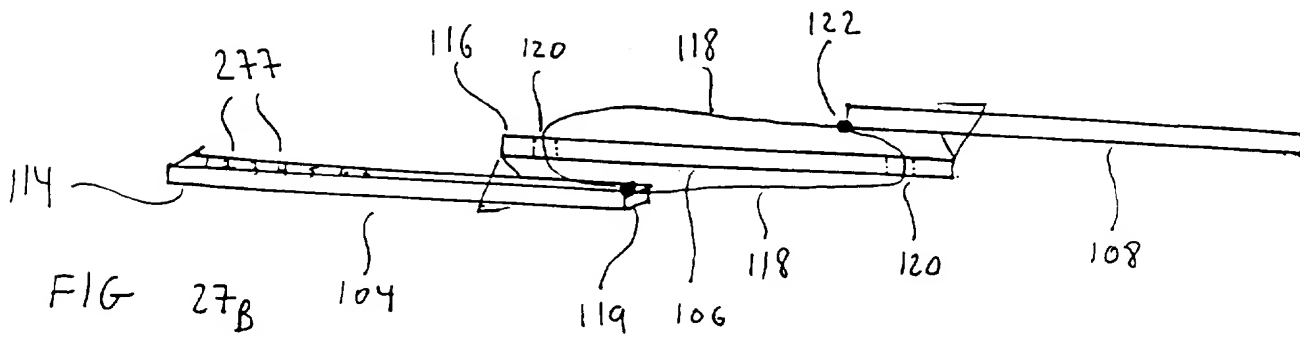
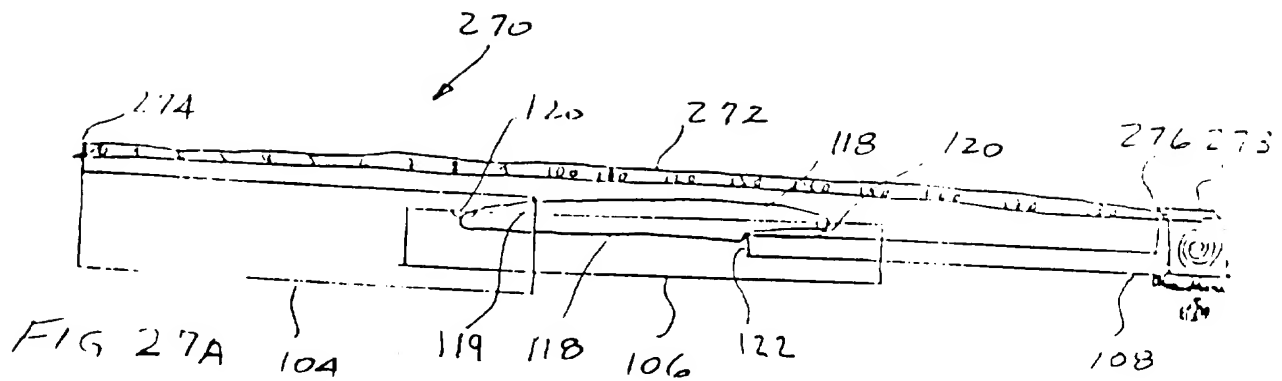


FIG 26



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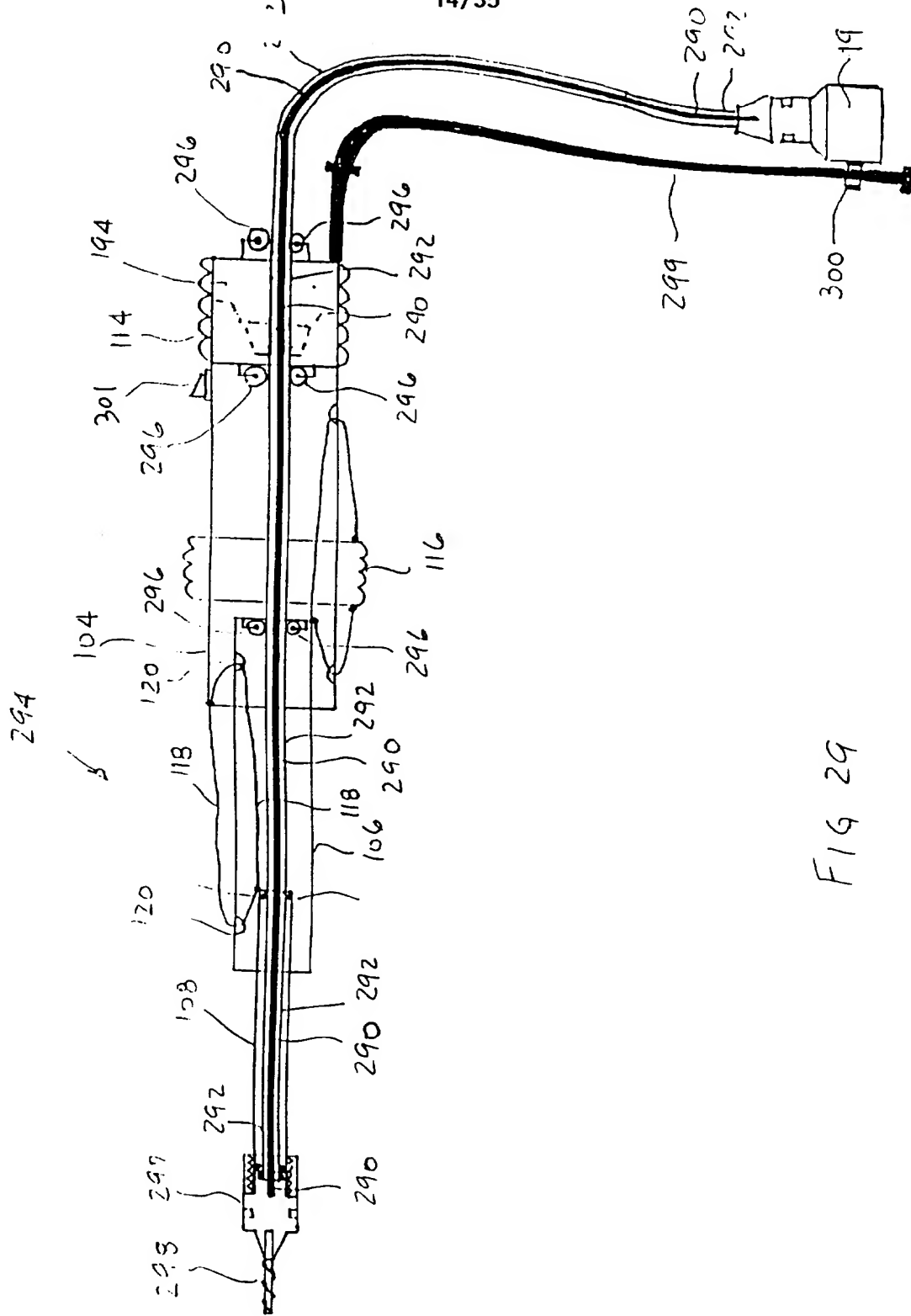


FIG 29

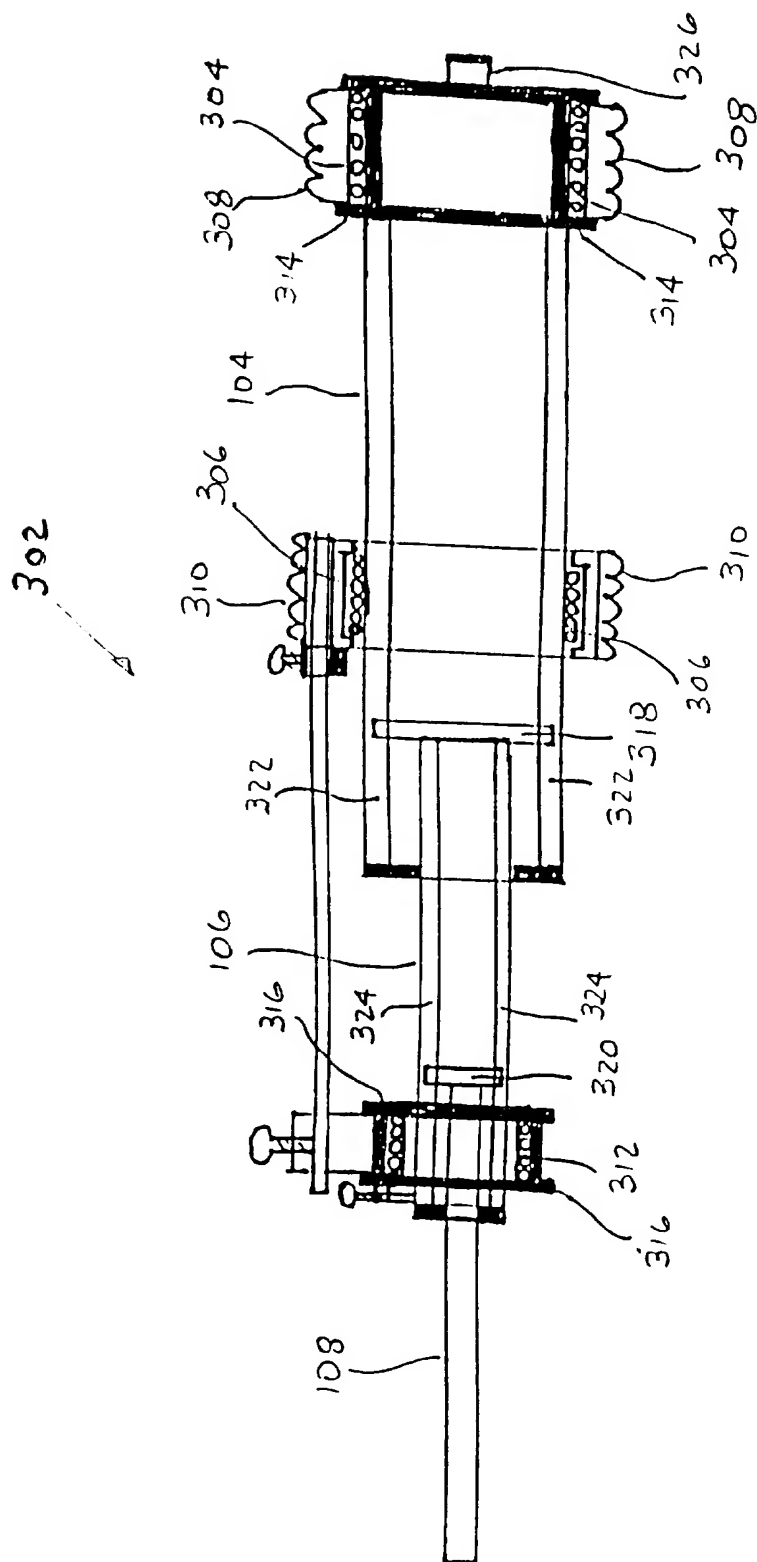
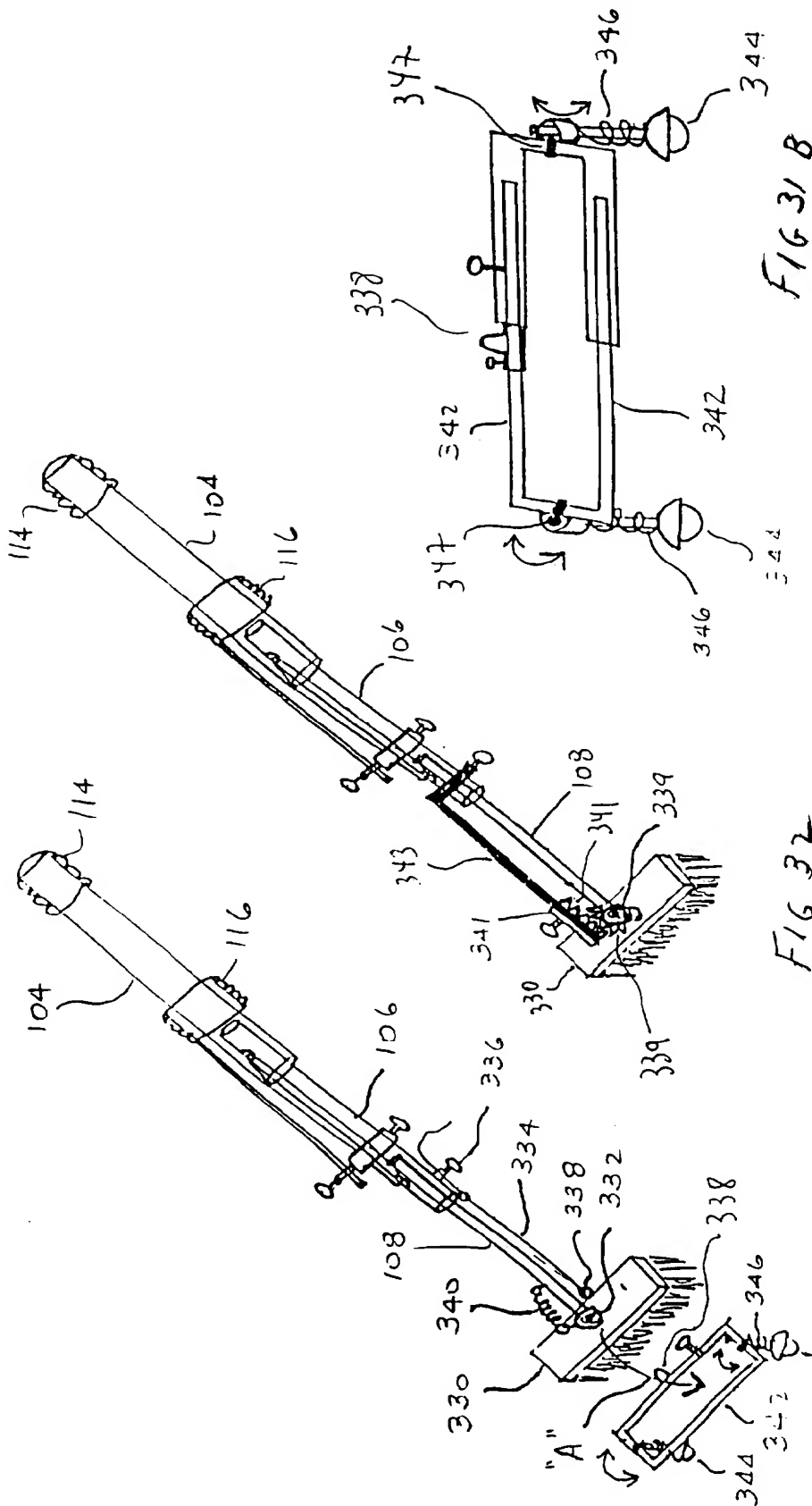


Fig 30



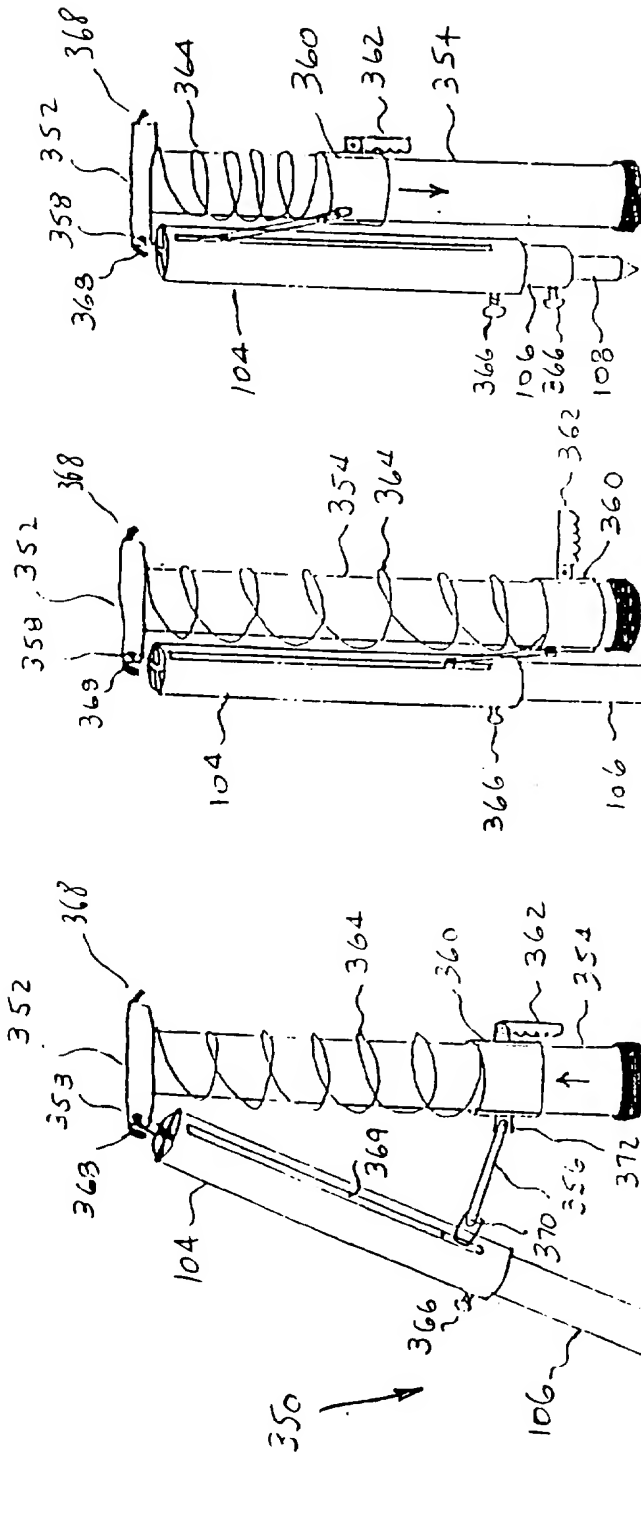


FIG 33A

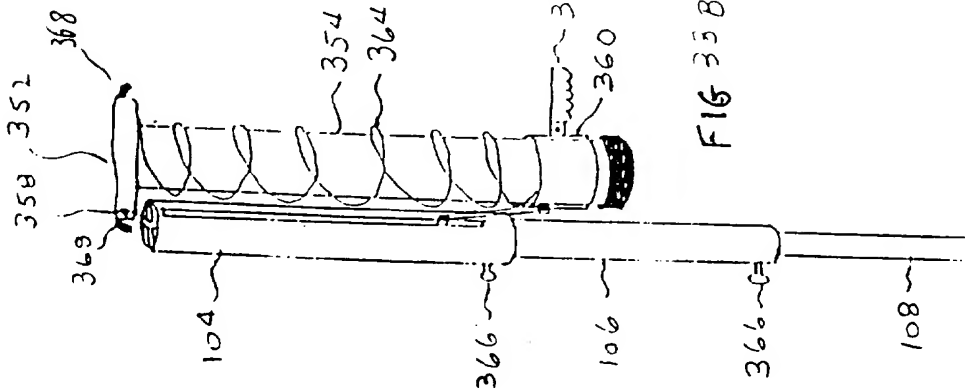


FIG 33B

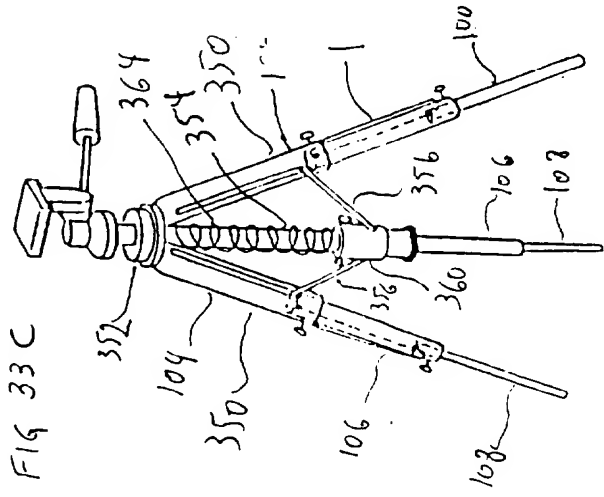


FIG 33C

FIG 34

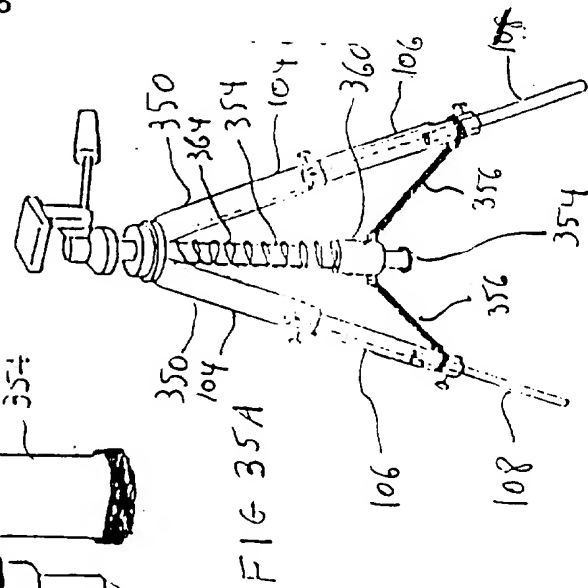
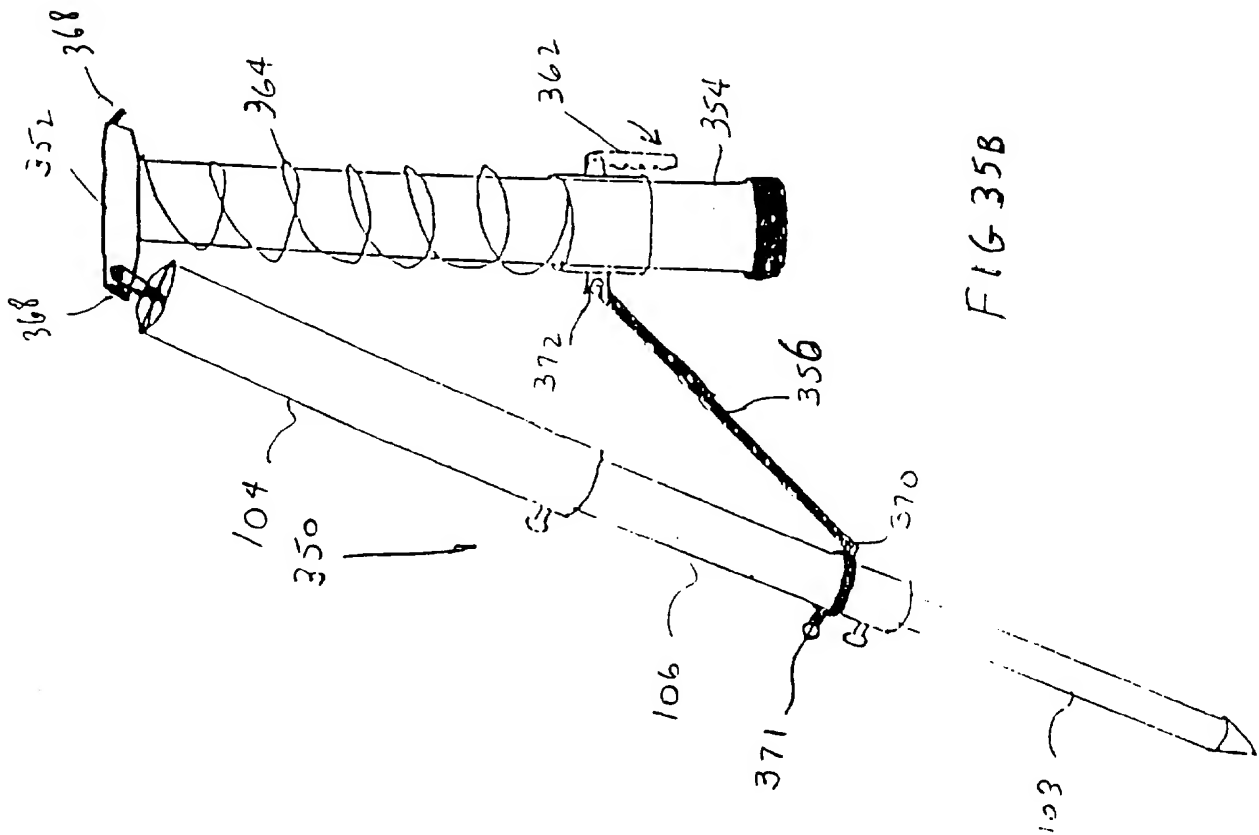
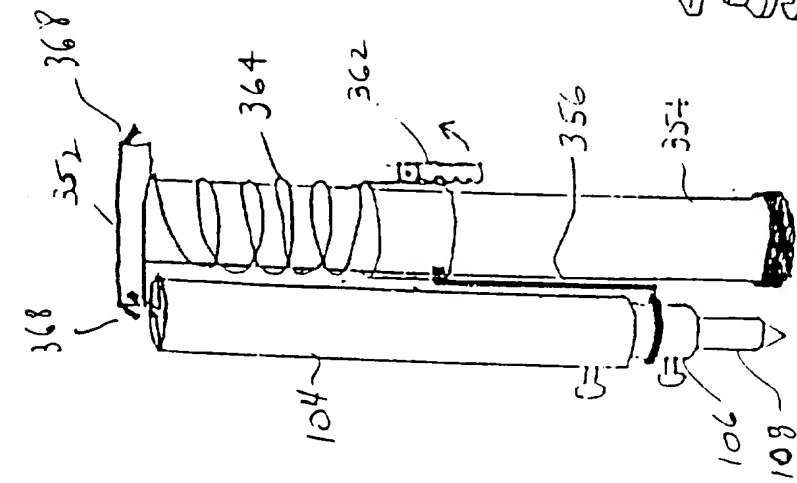
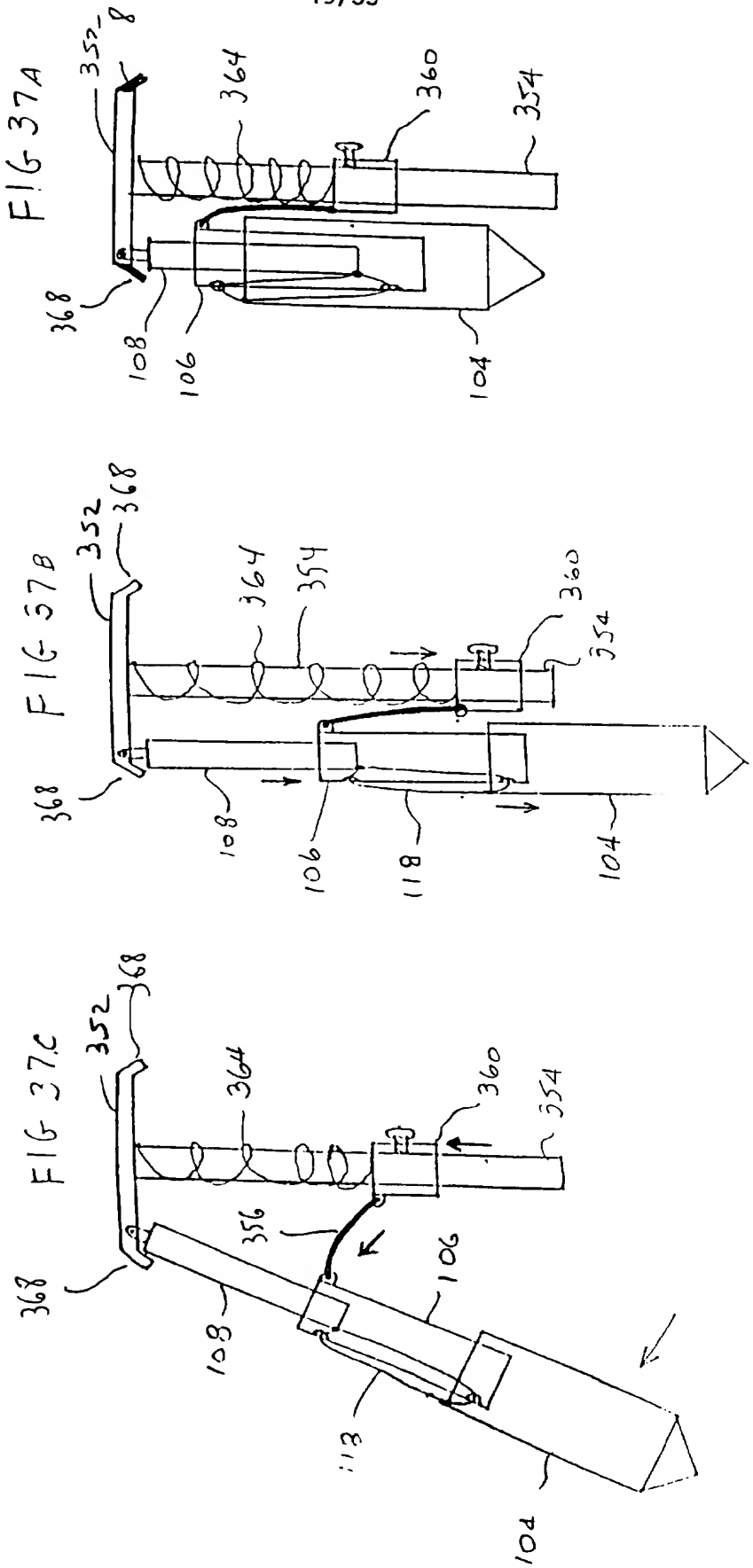
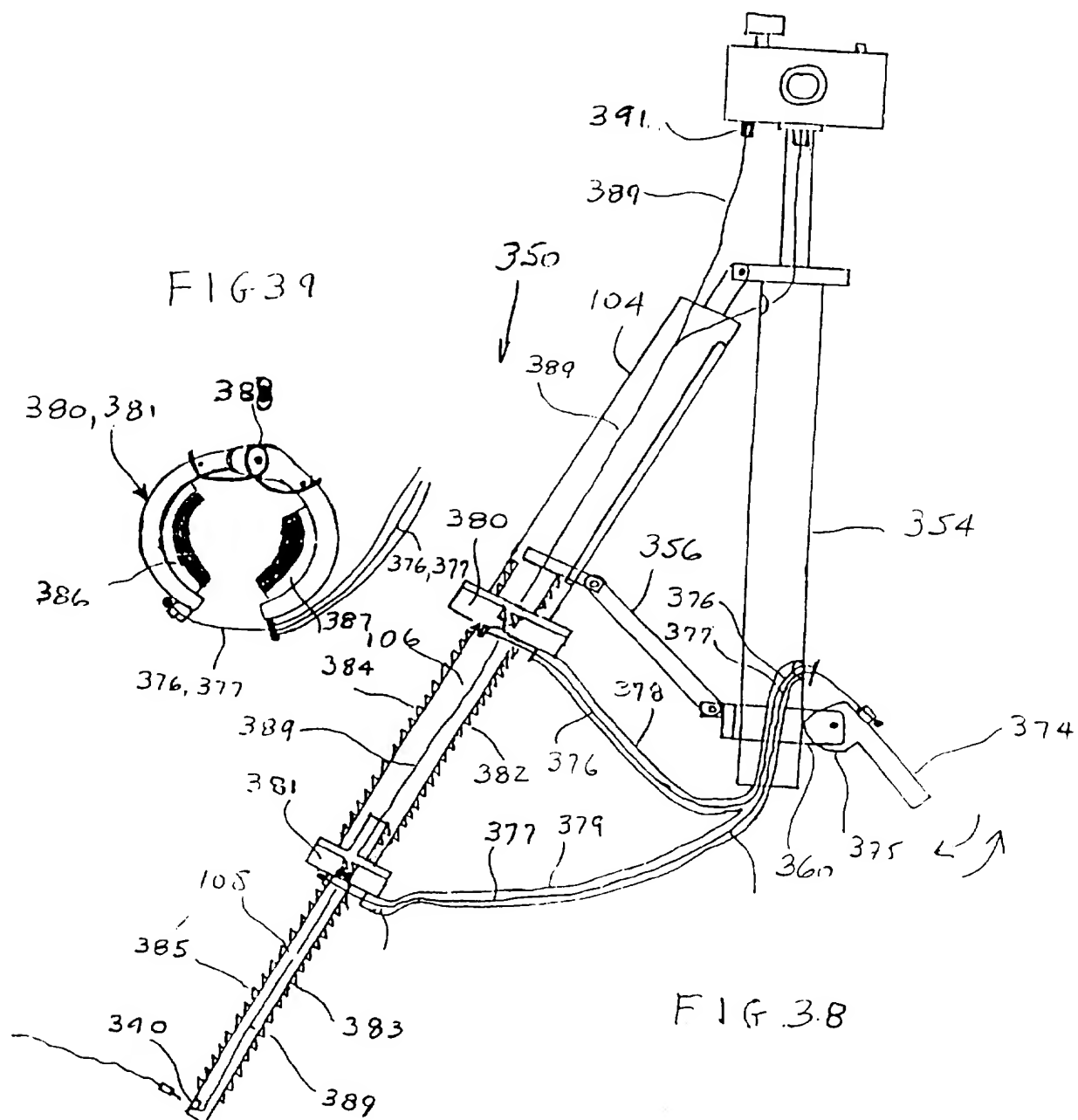


FIG 36







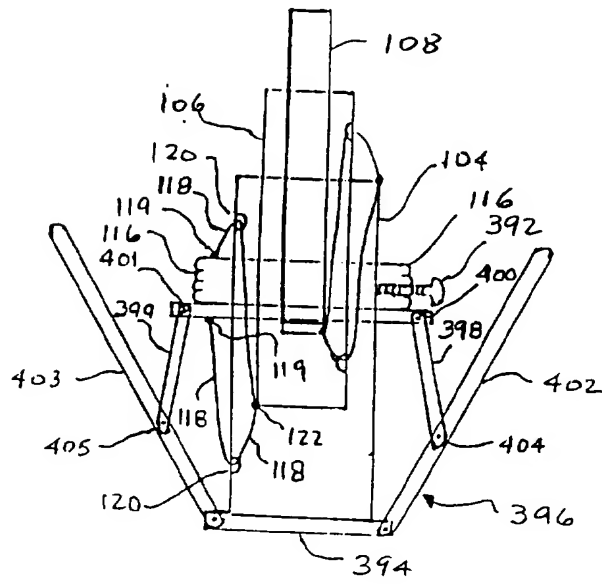


FIG 40 A

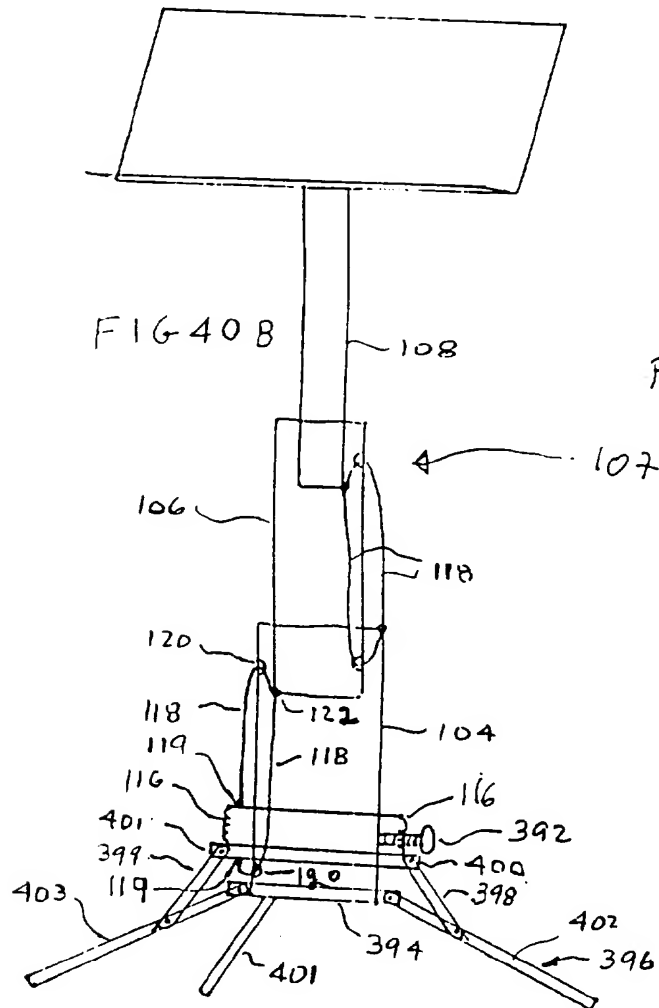
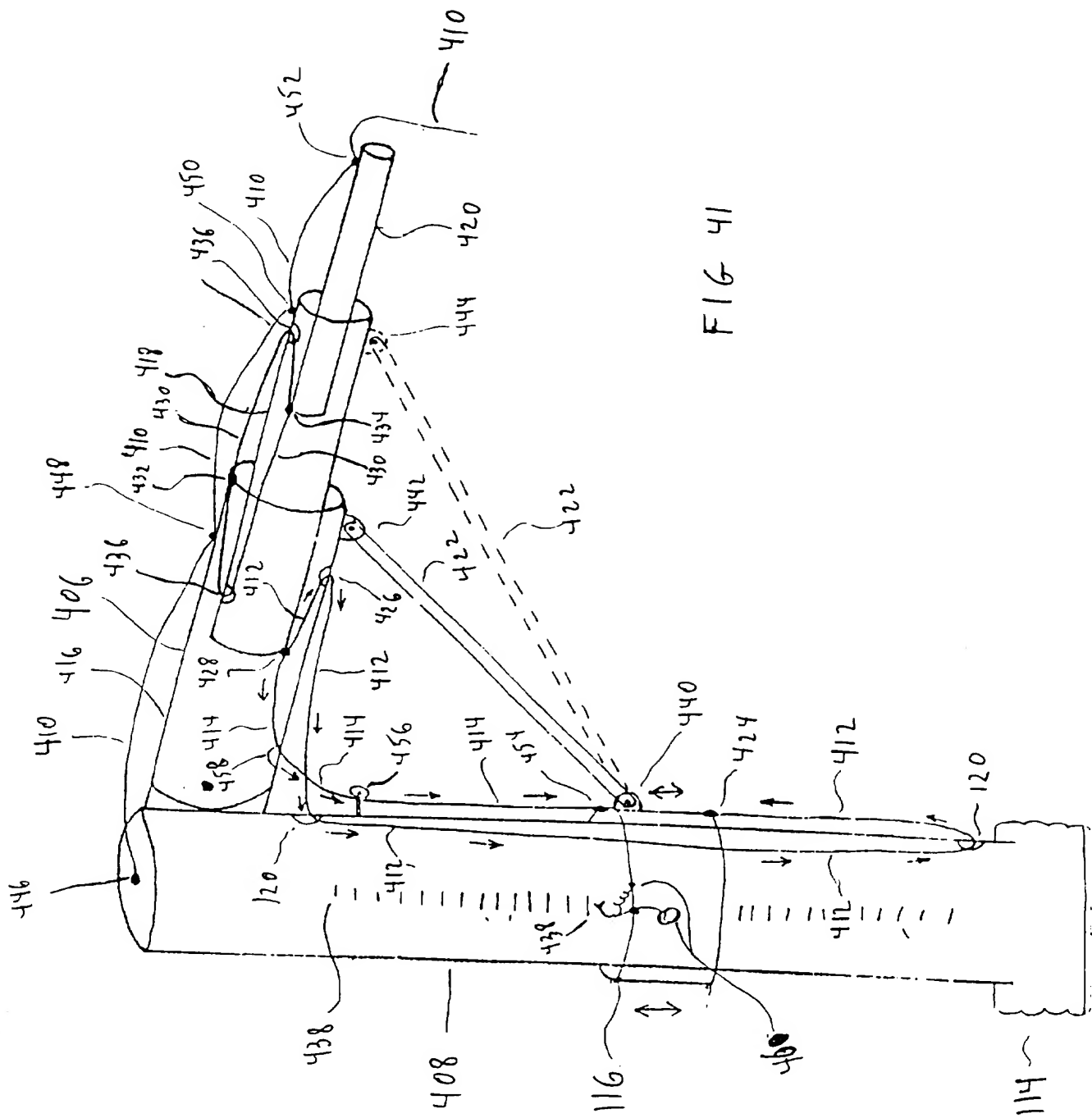
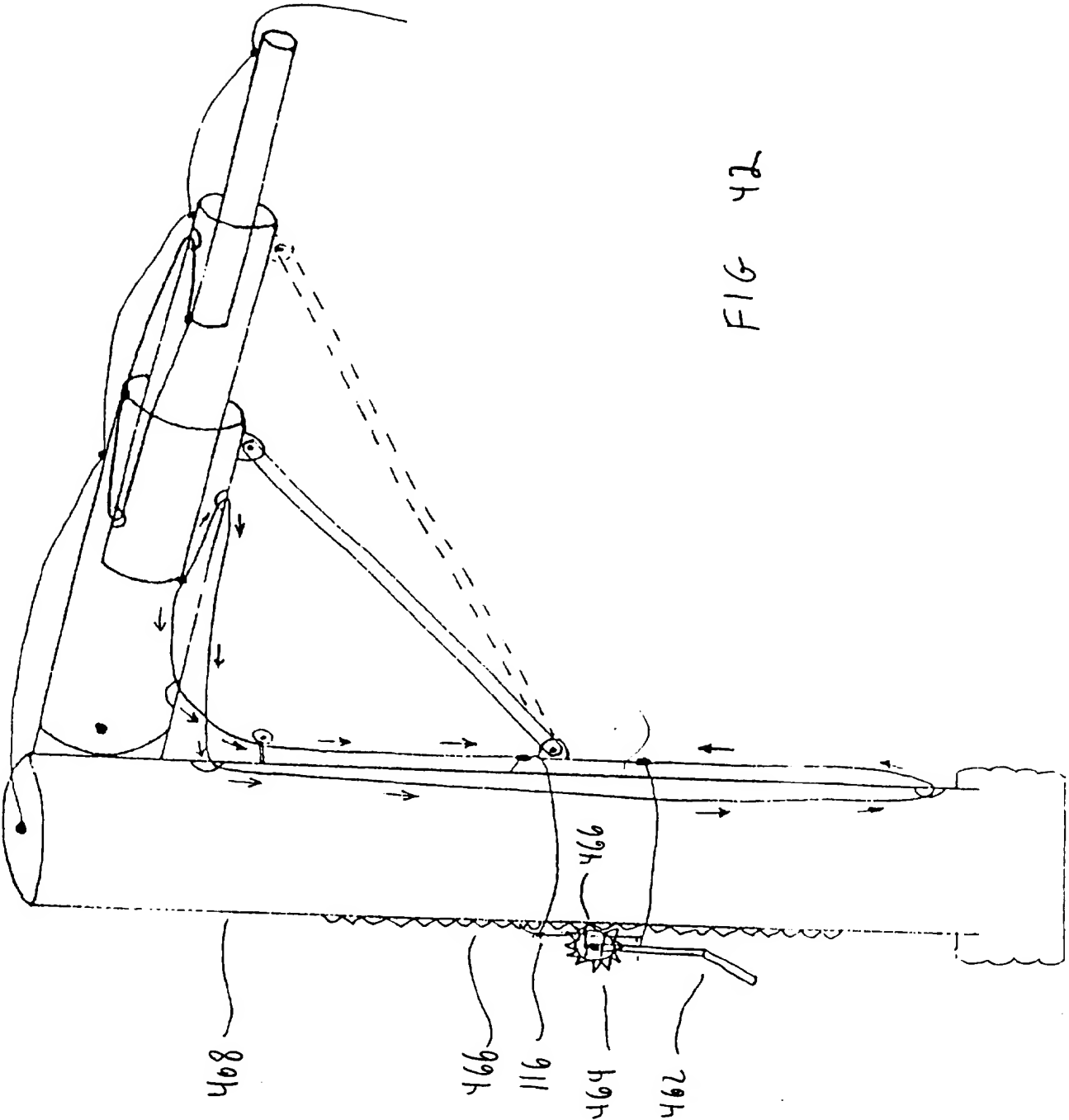


FIG 40 B

FIG 40 B





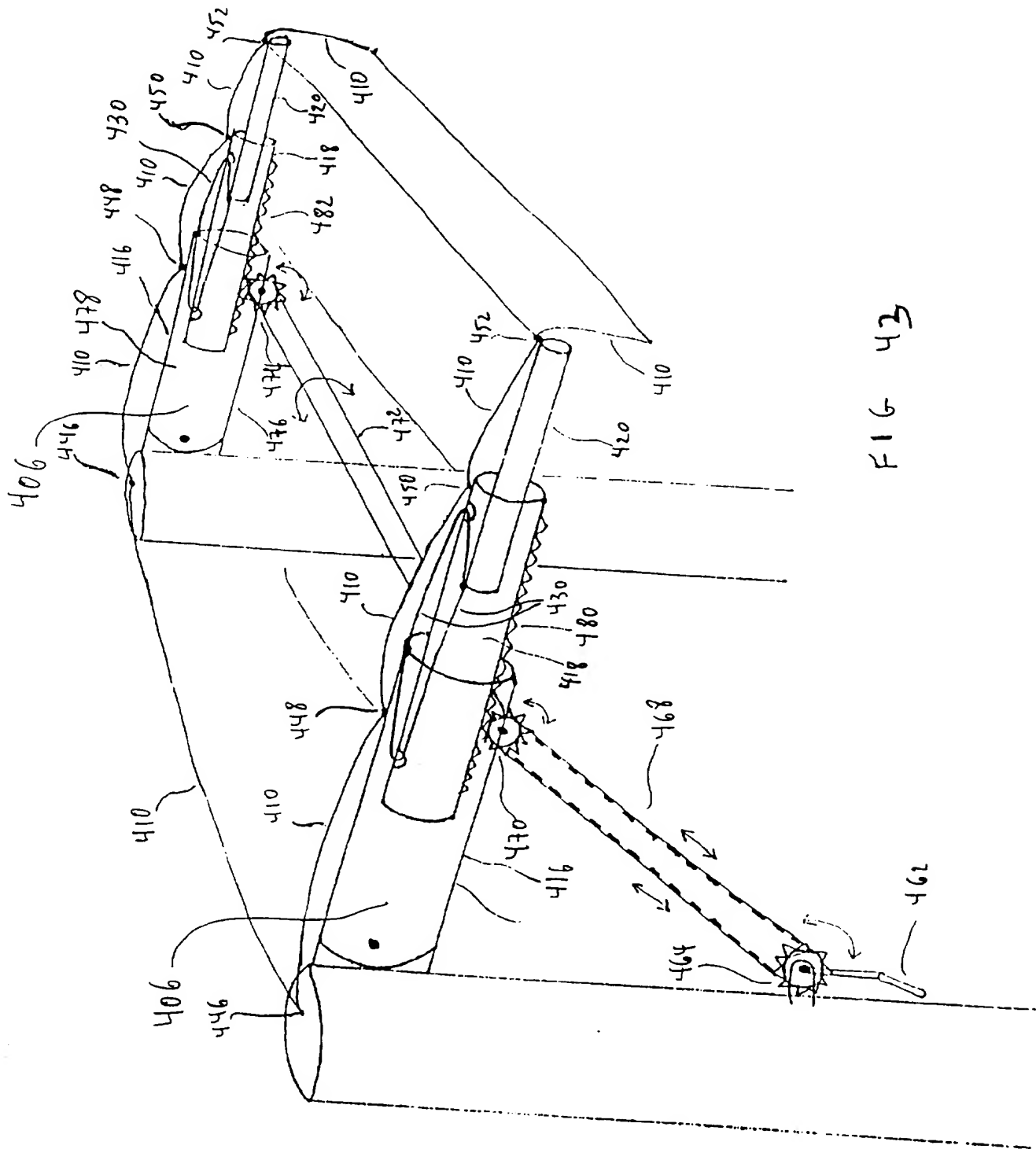


FIG 43

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FIG 44A

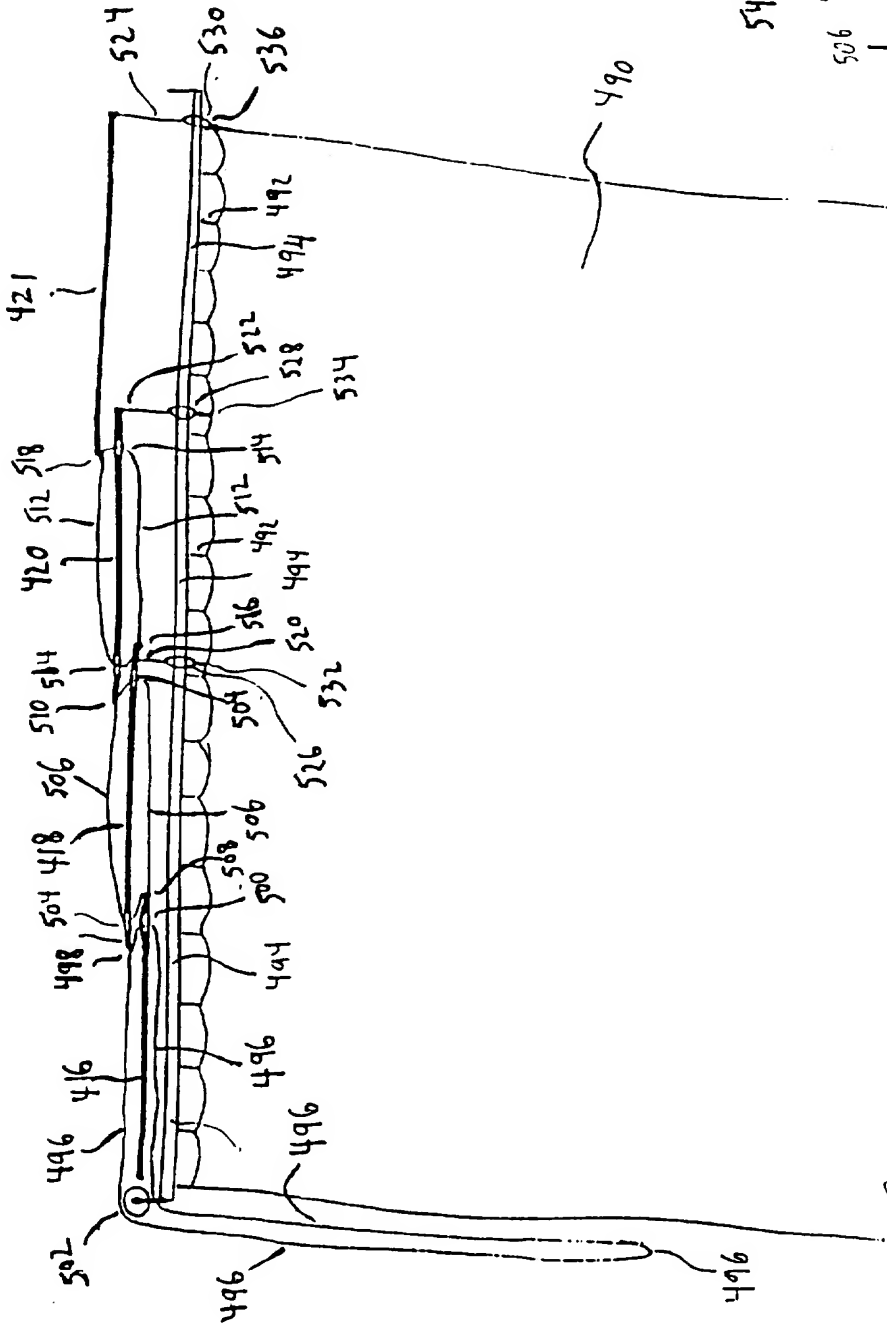


FIG 44D

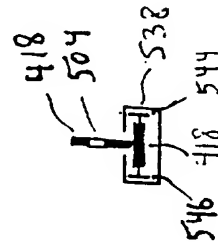


FIG 44C

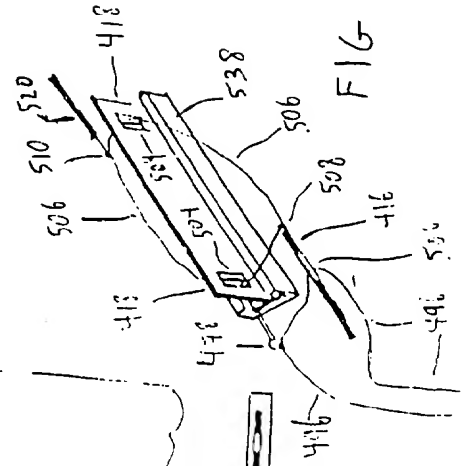


FIG 44B

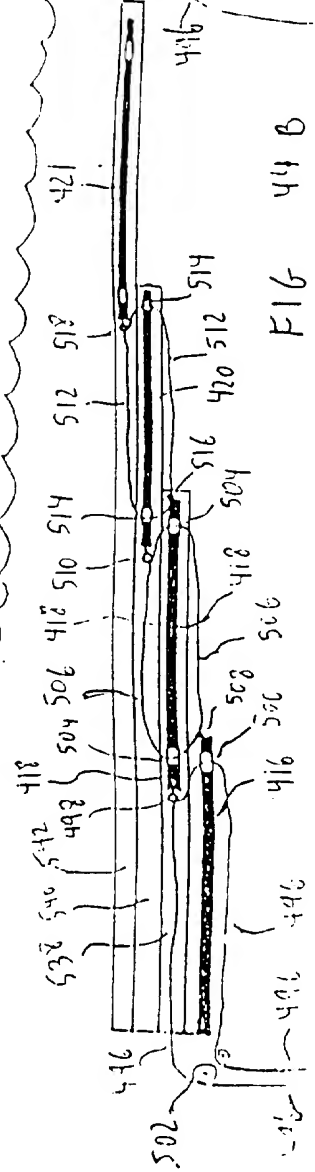


FIG-45 A

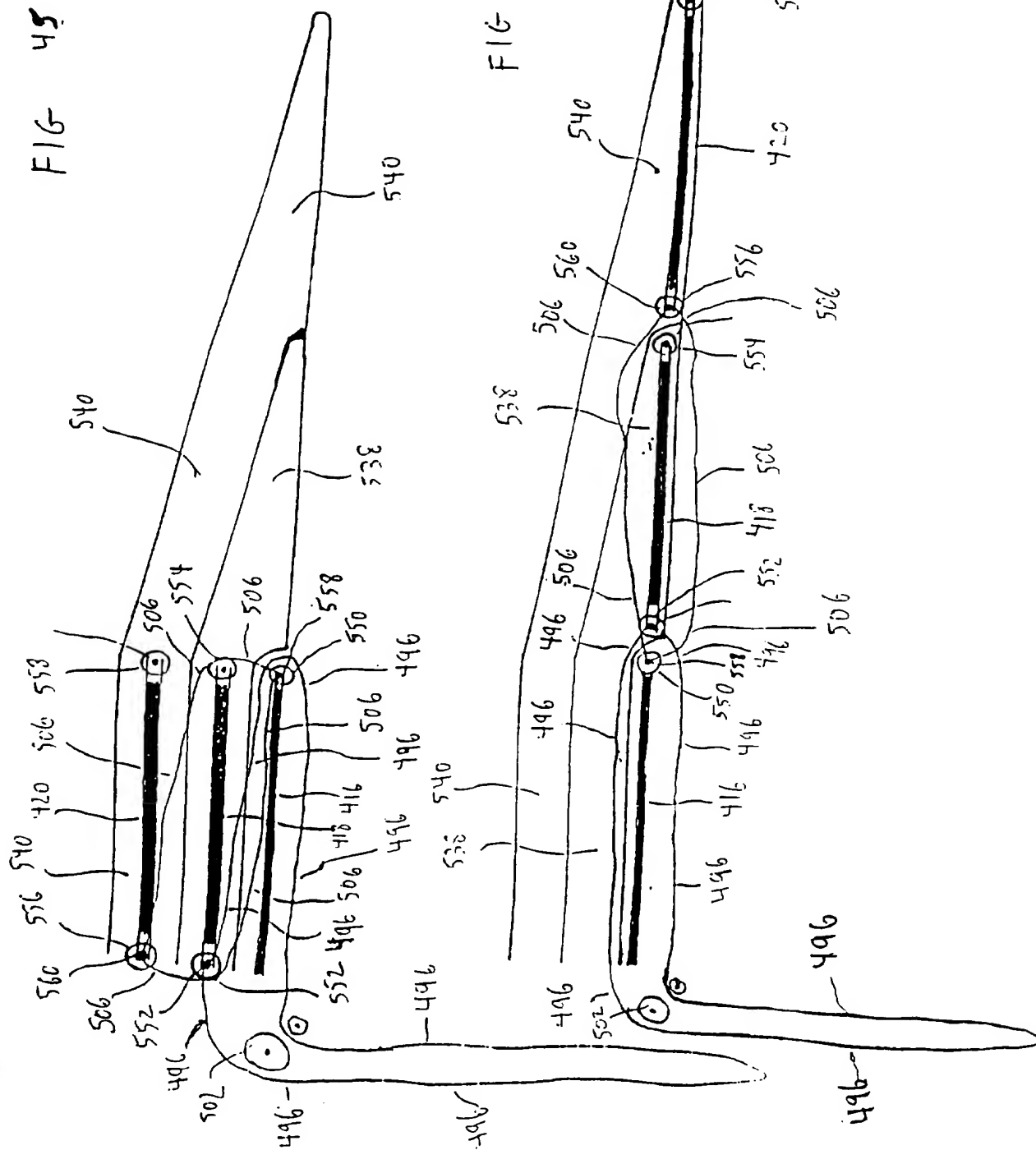
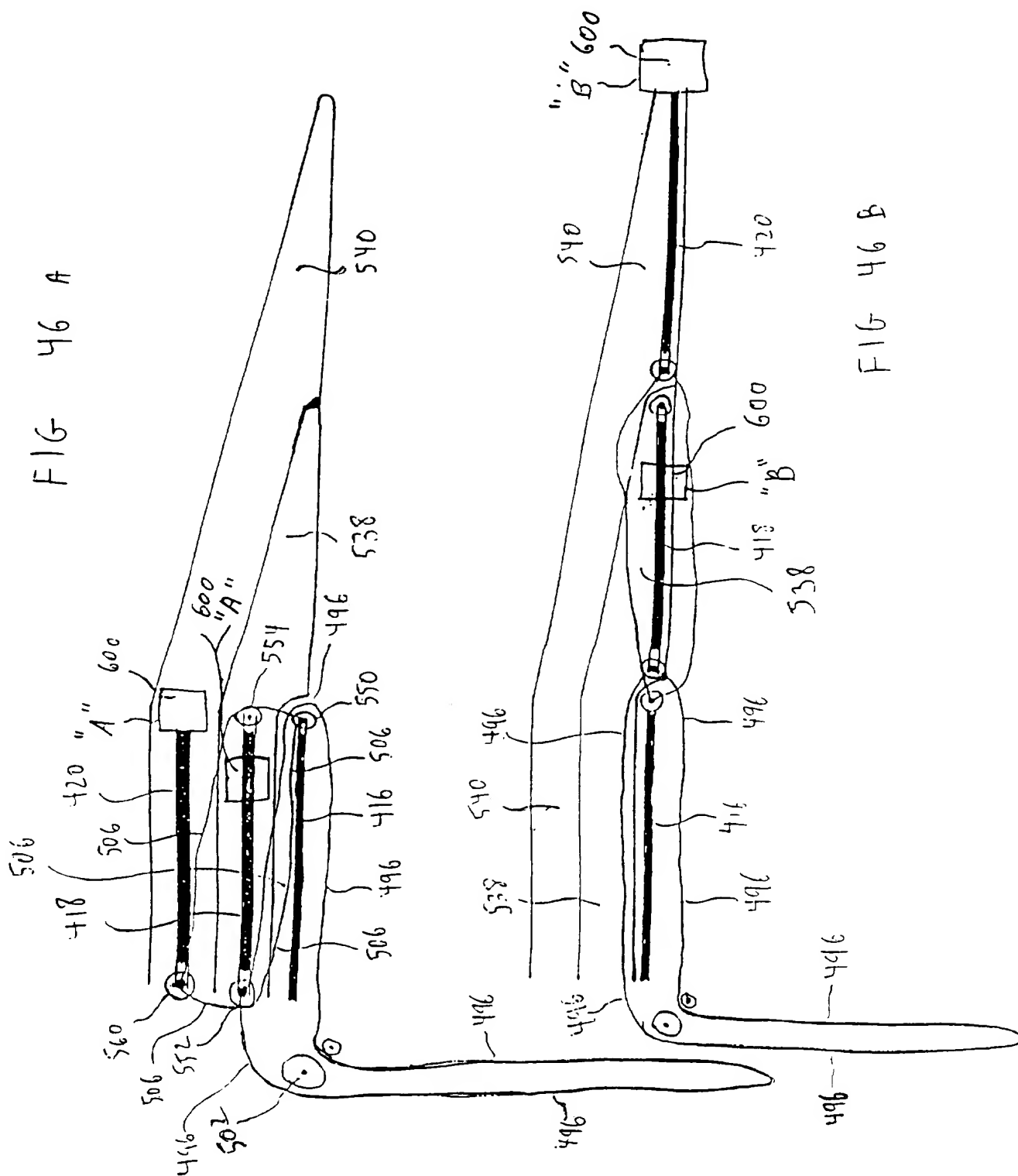




FIG 46 A



F16 46 B

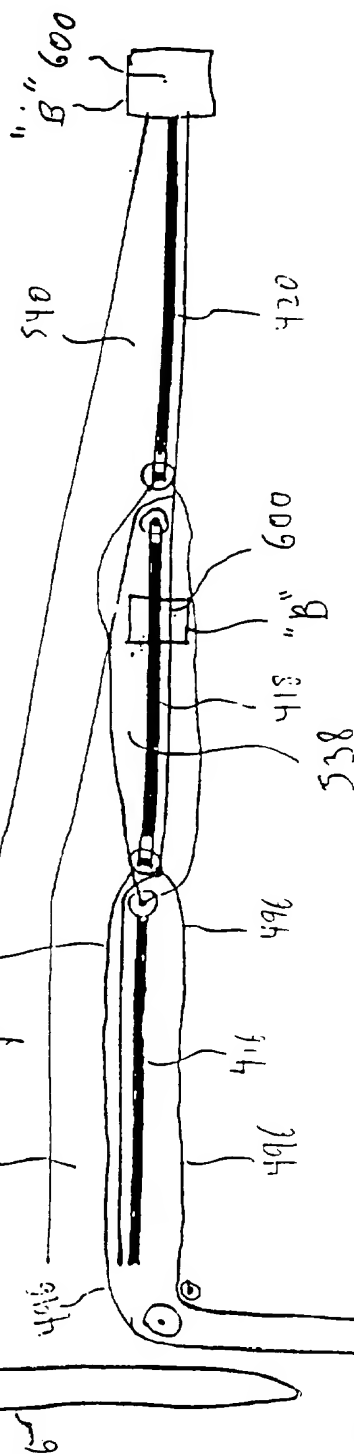


FIG 47

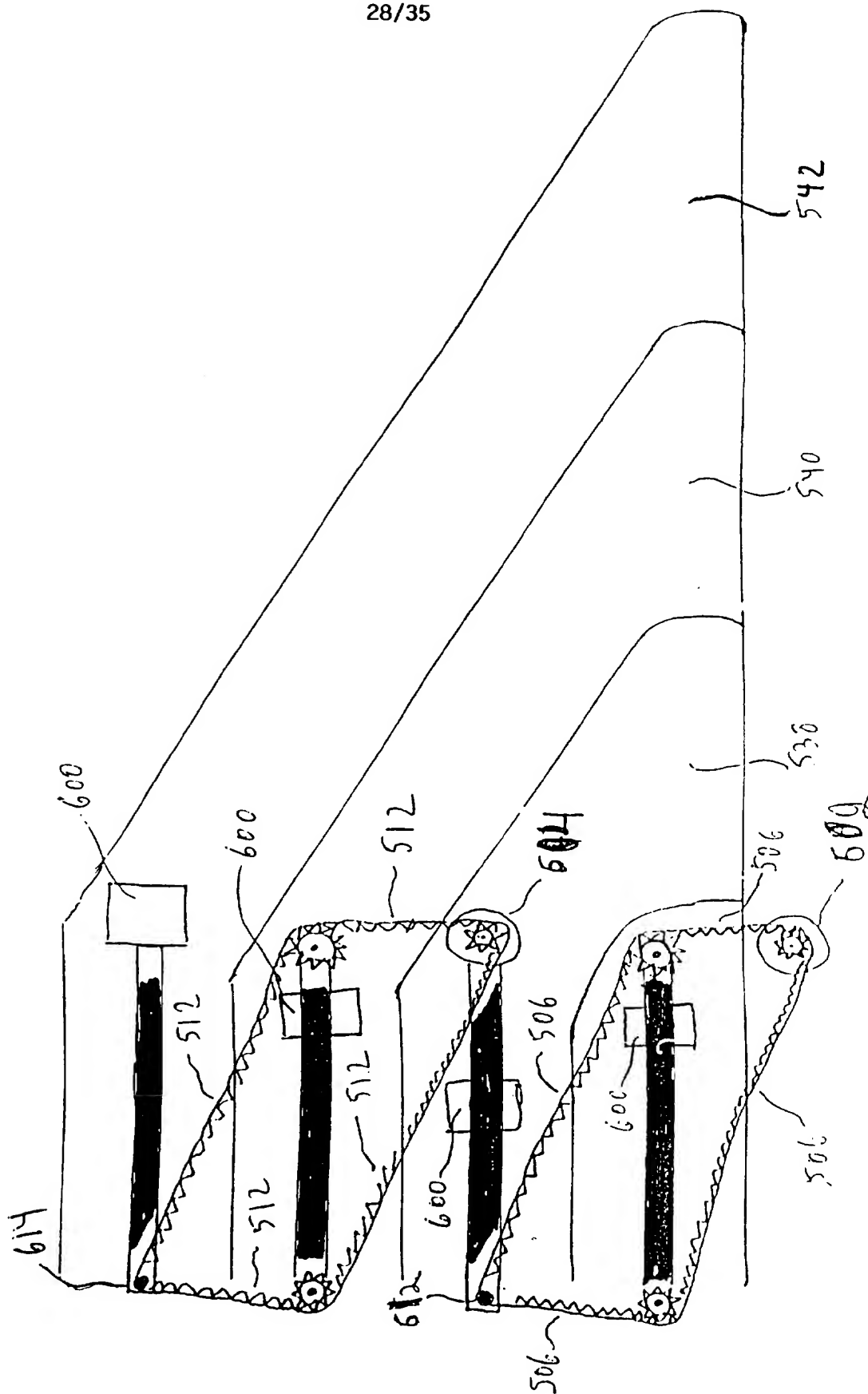
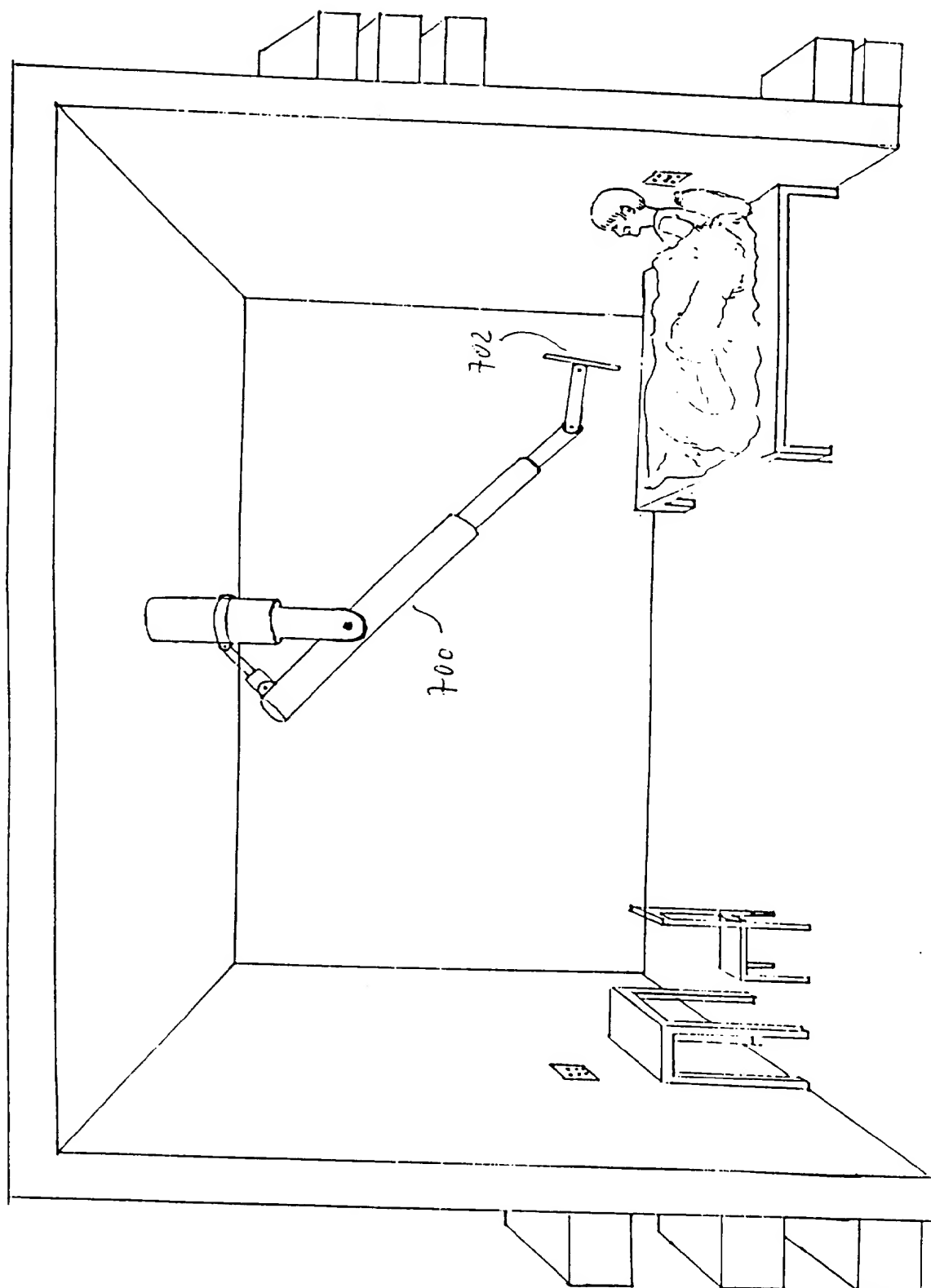


FIG 48



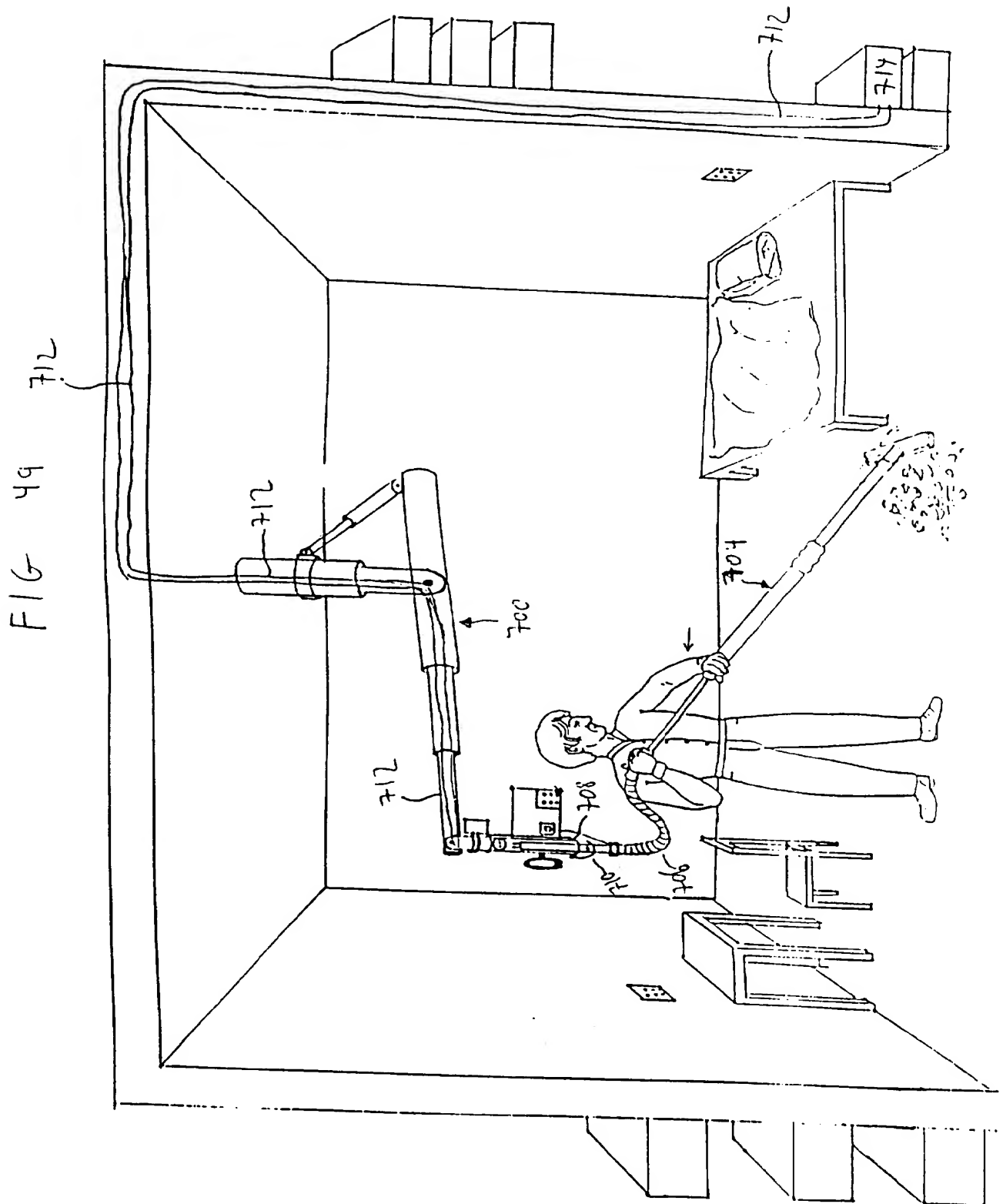


FIG 50

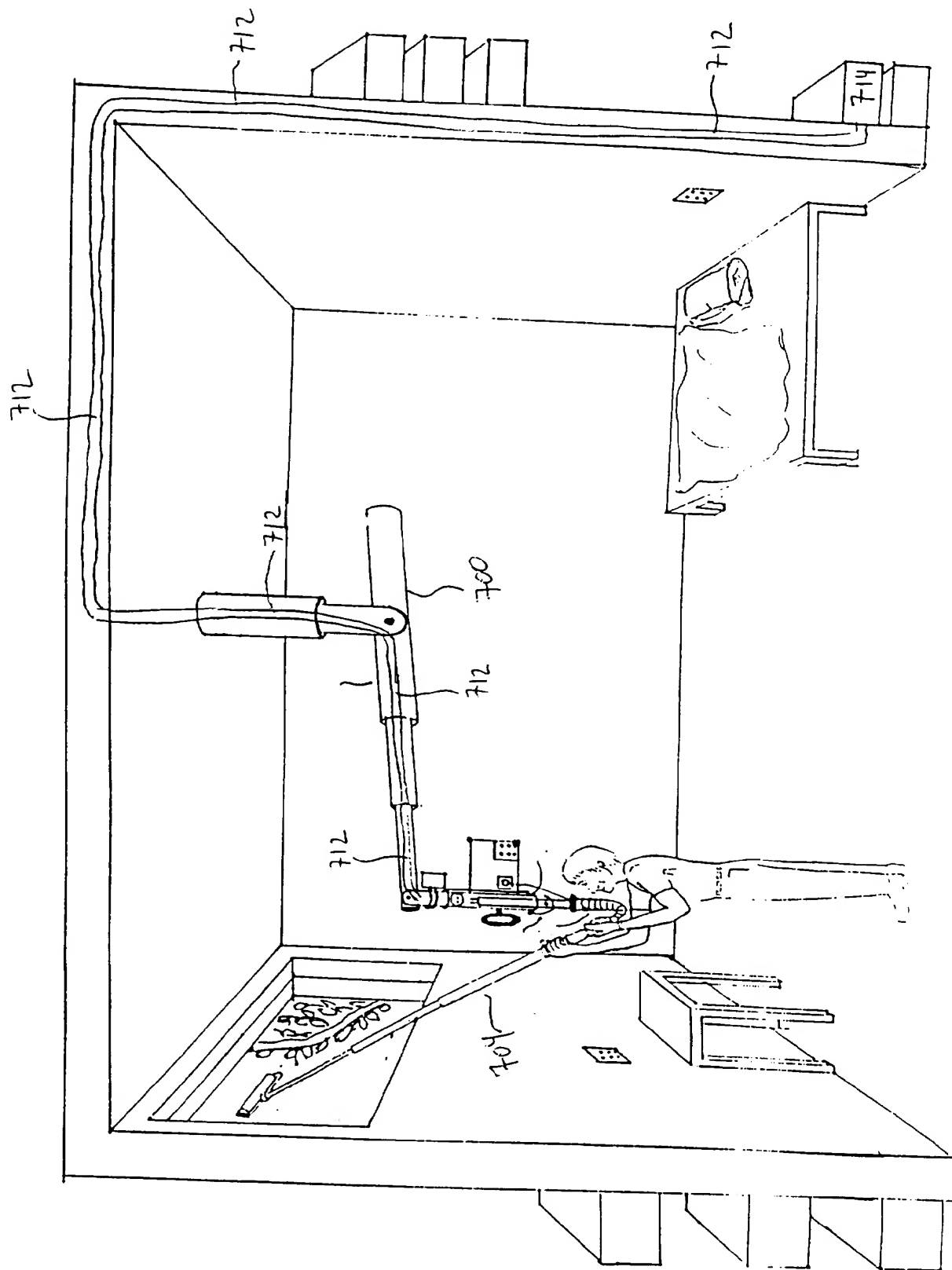
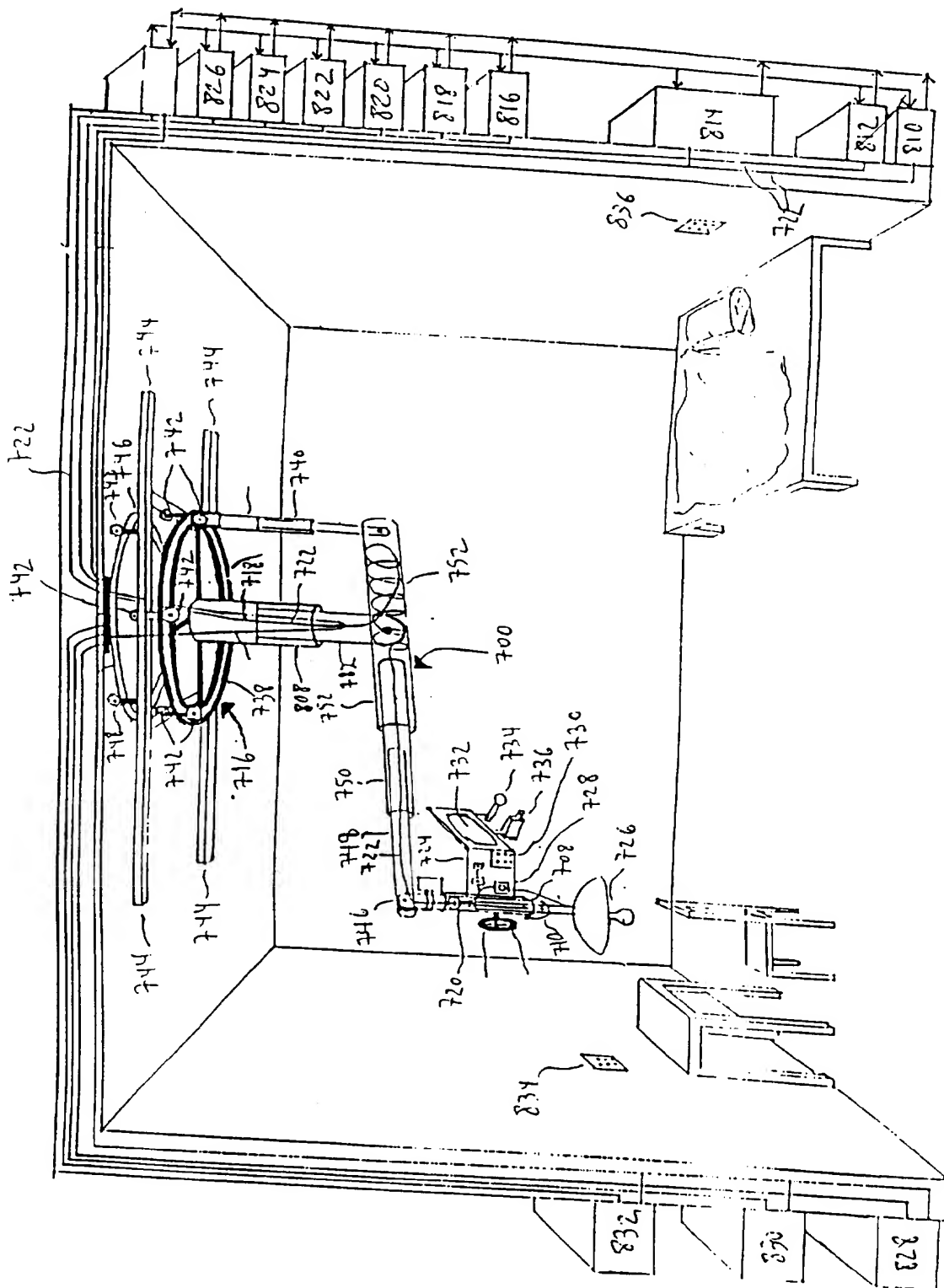
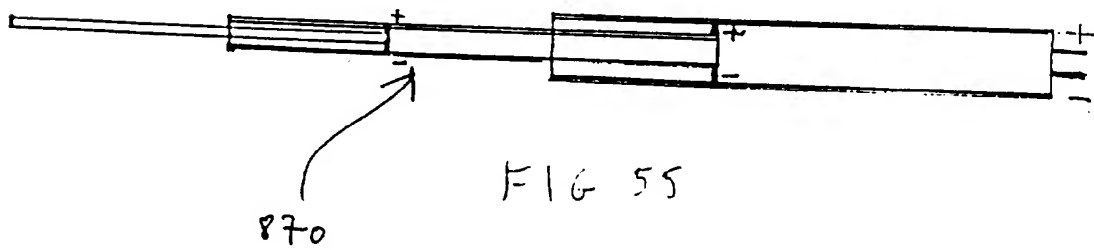
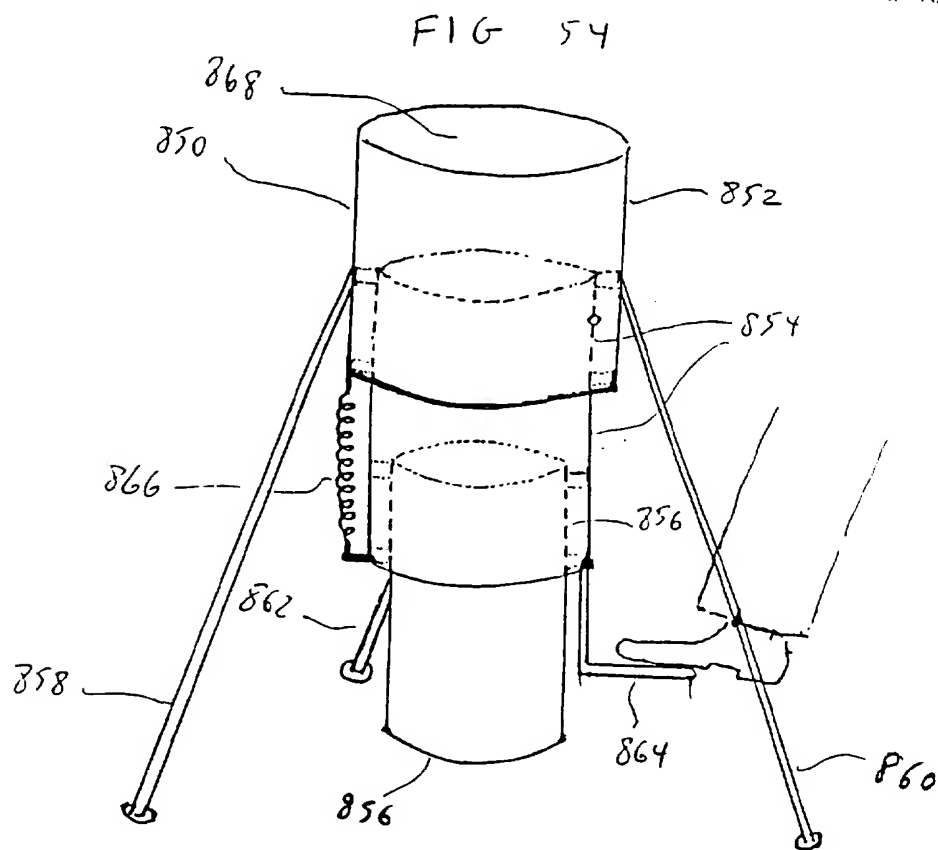
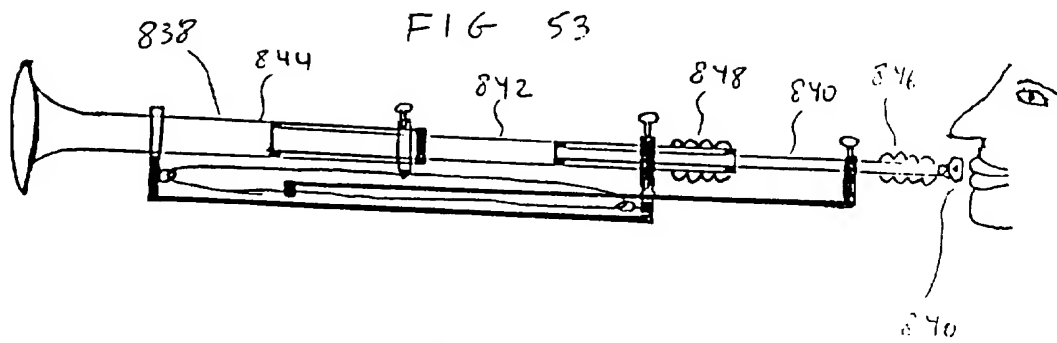


FIG 51





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FIG 56

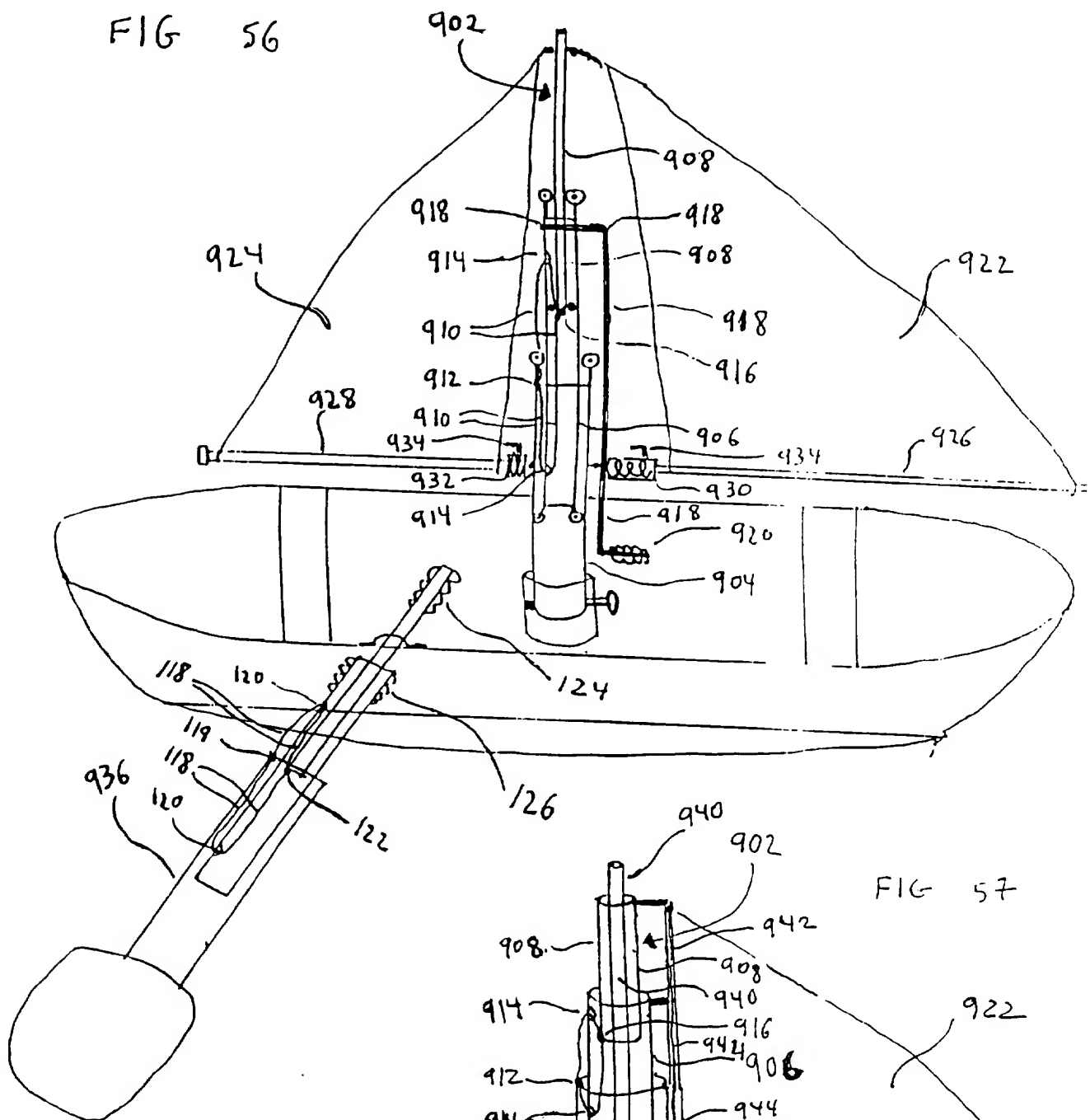
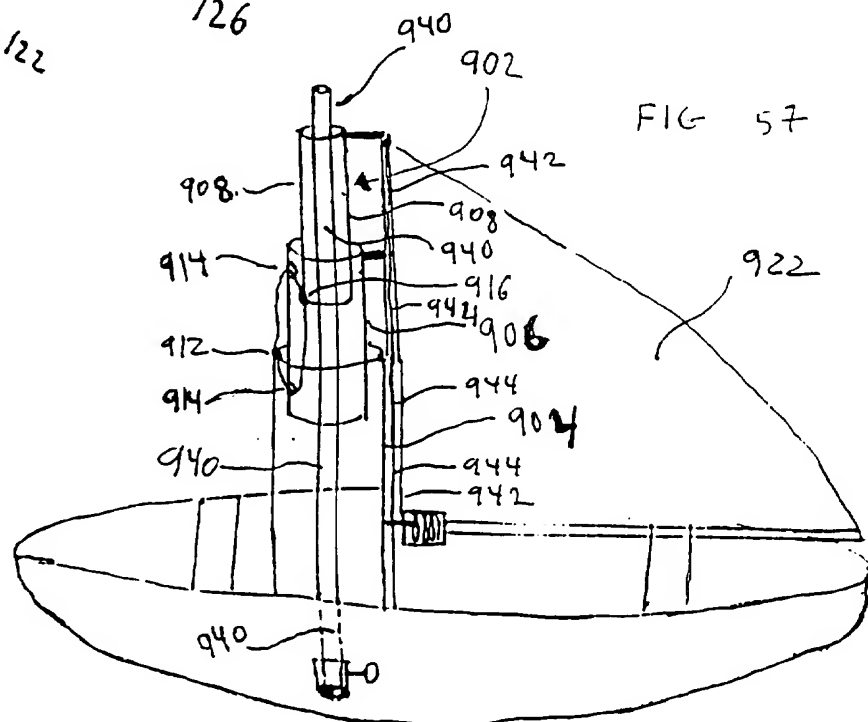


FIG 57



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US96/01209

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) : F16L 27/00; B25J 1/02

US CL : 403/109; 294/19.1; 15/144.4; 16/115

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : Please See Extra Sheet.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ---- Y ---- A	US, A, 326,336 (SANDBERG ET AL) 15 September 1885, entire document.	1, 2, 4, 5, 7, 8, 12, 36 ----- 15, 24, 30, 43- 45, 47 ----- 48
X	US, A, 399,313 (BRADFORD) 12 March 1889, col. 2, lines 50-57.	1, 16-18, 38
X	US, A, 1,325,053 (STEIDLE) 16 December 1919, page 1, lines 59-61.	1, 2, 22, 46
X	US, A, 198,465 (METZ ET AL) 25 December 1877, col. 2, lines 6-11.	1, 38, 39



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*A* document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
*E* earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*&* document member of the same patent family
*O* document referring to an oral disclosure, use, exhibition or other means	
*P* document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

28 MAY 1996

Date of mailing of the international search report

07 JUN 1996

Name and mailing address of the ISA/US  
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ANTHONY KNIGHT

Telephone No. (703) 305-2168

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US96/01209

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X ---- Y	US, A, 1,456,478 (WHITE) 22 May 1923, entire document.	1, 2, 5, 7-11, 16-18, 23, 40 ----- 24
X ---- Y	US, A, 2,795,050 (VAN FLEET) 11 June 1957, entire document.	1, 13, 14, 31, 32 ----- 15
X ---- Y	US, A, 5,267,583 (WU) 07 December 1993, col. 4, line 65 to col. 5, line 29.	1, 3, 25, 28, 29 ----- 30
X	US, A, 4,779,650 (SARGENT ET AL) 25 October 1988, col. 3, lines 12-26.	6, 19-21
X	US, A, 5,267,712 (SHEN) 07 December 1993, col. 1, lines 26-39.	26
X	US, A, 5,037,057 (ANDREWS) 06 August 1991, col. 3, lines 47-51.	27
Y	US, A, 4,068,673 (BERNARDI) 17 January 1978, col. 2, lines 9-14.	30
Y	US, A, 3,076,263 (MUSTO) 05 February 1963, col. 1, lines 61-69.	33-35, 37
X	US, A, 4,388,033 (PIPES) 14 June 1983, entire document.	38, 41, 42
Y	DE, A, 3,630,346 (SCHREIBER) 17 March 1988, entire document.	43
Y	DE, A, 258,819 (SUCHY) 18 April 1913, entire document.	43
Y	US, A, 2,546,452 (KMIELIAUSKAS) 27 March 1951, entire document.	44
Y	US, A, 1,277,285 (BADGER) 27 August 1918, page 1, lines 14-32.	44
Y	GB, A, 678,827 (GIBSON) 10 September 1952, page 2, lines 8-16.	44
Y, E	US, A, 5,493,480 (HUANG) 20 February 1996, Fig. 1, col. 2, lines 29-35.	45

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US96/01209

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,606,525 (LOMBARDI) 19 August 1986, col. 1, line 60.	47
A	US, A, 2,776,168 (SCHWEDA) 01 January 1957.	48

# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US96/01209

## B. FIELDS SEARCHED

Minimum documentation searched

Classification System: U.S.

403/109; 294/1.4, 1.5, 19.1, 22, 23, 57; 15/144.3, 144.4; 16/115; 52/118, 121; 56/332-340; 248/157, 161, 165, 333, 460, 404, 188.7; 74/89.2, 89.22, 110, 501.6; 81/53.1-53-12, 177.2; 182/40, 63, 66, 207, 208, 213; 187/9E; 212/184, 187, 199, 230, 264, 267, 269; 84/412, 391, 330, 386; 285/165, 302; 362/176, 102; 33/444, 445, 757, 809